...ECHNOLOGY DEPT.

MAY, 1956

RUBBER WORLD

Contents, page 225

NOW IN ITS 67th YEAR

"RUBBER RAILROADS"

By F. L. Blanchard, page 227

A BILL BROTHERS PUBLICATION

For Trouble-Free Processing This Summer

USE

NEOPRENE TYPE W

A General-Purpose Neoprene

Stable in storage, even at midsummer temperature conditions. Processes uniformly in summer or winter

. . . and, of course,

Excellent aging
Oil, chemical, solvent, acid and heat resistant.

These advantages apply also to other W types:
Type WRT — Crystallization-Resistant.
Type WHV — High-Viscosity Type.

If your neoprene compounds are made from Type GN, you can improve processing this summer by using a blend of 75 parts Type GN and 25 parts Type W. There will be little, if any, change in cured physical properties

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BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

RUBBER WORLD, May, 1956, Vol. 134, No. 2. Published monthly by BILL BROTHERS PUBLISHING CORP. Office of Publication, 1309 Noble Street, Philadelphia, Pa., with Editorial and Executive Offices at 386 Fourth Avenue, New York 16, N. Y., U.S.A. Entered as Second Class Matter at the Post Office at Philadelphia, Pa., under the act of March 3, 1879. Subscription United States $5.00 per year; Canada, $6.00. All other countries $7.00. Single Copies 50 cents. Address Mail to N. Y. Office.

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B.F.Goodrich Chemical *raw materials*

HYCAR AMERICAN RUBBER CAN BE TAILORED TO YOUR REQUIREMENTS

If this is your problem:

You need a flexible material that is highly resistant to aromatic fuels, oils and solvent. The answer is Hycar 1041, a high acrylonitrile copolymer rubber—used in oil well parts, fuel cell liners, fuel hose, gaskets, O-rings, cements and adhesives. —***Hycar*** 1041

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If low temperatures make your problem critical, Hycar 1014 may be the answer. It's a low acrylonitrile copolymer especially designed to emphasize this property. —***Hycar*** 1014

These are but a few of the many Hycar American rubbers that are tailored to meet specific requirements. Literature is available listing the properties of standard materials. For copies write Dept. ES-5, B. F. Goodrich Chemical Company, Rose Bldg., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Hycar
Reg. U.S. Pat. Off.
American Rubber

B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

Call on PHILBLACK® for valuable information about carbon blacks!

We've been in the carbon black business for many years. In fact, Phillips pioneered the improved furnace blacks which have contributed so significantly to the manufacture of better rubber products. Over this period of time we have collected important data on rubber and have worked out many solutions to rubber problems.

Maybe you'd like more data on how to speed up processing time . . . how to improve accuracy of extrusions and moldings . . . how to increase flex life of rubber? Ask us about it. It is our business to help rubber manufacturers turn out better products . . . more easily and more profitably.

Take full advantage of all the helpful services available to you. For full information consult your Phillips technical representative.

Meet the Philblacks! DISCOVER WHAT THEY'LL DO FOR YOU!

A **Philblack A FEF Fast Extrusion Furnace Black**
Ideal for smooth tubing, accurate molding, satiny finish. Mixes easily. High, hot tensile. Disperses heat. Non-staining.

O **Philblack O HAF High Abrasion Furnace Black**
For long, durable life. Good electrical conductivity. Excellent flex. Fine dispersion.

I **Philblack I ISAF Intermediate Super Abrasion Furnace Black**
Superior abrasion resistance at moderate cost. Very high resistance to cuts and cracks. More tread miles at high speeds.

E **Philblack E SAF Super Abrasion Furnace Black**
Toughest black on the market. Extreme abrasion resistance. Withstands aging, cracking, cutting and chipping.

Phillips 66

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Naugatuck Thiurams

Naugatuck Thiuram-Type Accelerators:

MONEX® (tetramethylthiuram monosulfide) powder or naugets.

PENTEX (tetrabutylthiuram monosulfide) liquid.

PENTEX FLOUR (1 part Pentex with 7 parts clay) powder, providing delayed action for use in sponge.

MORFEX (1 part Monex with 3 parts zinc 2-mercaptobenzothiazole) powder.

TUEX® tetramethylthiuram disulfide) and ETHYL TUEX (tetraethylthiuram disulfide) powder or naugets. The standard accelerator for Butyl.

AS AN IMPORTANT PART of its extensive line of primary and secondary accelerators, Naugatuck—the world's leading manufacturer of rubber chemicals—offers a wide choice of thiuram-type accelerators and vulcanizing agents.

Fast, powerful and nondiscoloring, these Naugatuck products are extremely economical to use because so little is required. They yield vulcanizates having excellent aging qualities, high tensiles, low set and high resilience, similar to those produced by Naugatuck's dithiocarbonates, but are less sensitive to heat and so provide greater processing safety.

The thiuram disulfides, TUEX and ETHYL TUEX, are unique in that each contains an atom of sulfur available for vulcanization. This permits them to function as accelerators with normal to very low sulfur ratios, or as vulcanizing agents with no added sulfur. On the other hand, the monosulfides, MONEX and PENTEX, promote vulcanization only when sulfur is added. Slightly less active than the disulfides, they exhibit a definite delayed action that makes for even greater processing safety. Both function well in the presence of carbon blacks, acidic fillers or softeners.

To give your natural, R-S, nitrile or Butyl rubber products the super-aging qualities you want, at low cost, try these Naugatuck products... either as primary accelerators or as excellent secondaries with Naugatuck's thiazoles (M-B-T, M-B-T-S or O-X-A-F.). Write, or contact address below for detailed information.

Fast acceleration, super aging... at low cost!

Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

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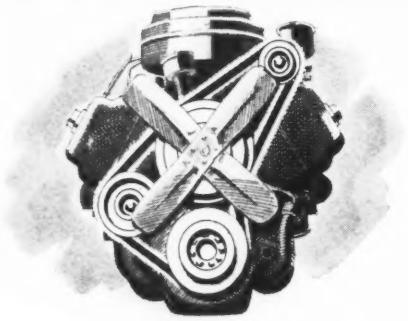
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices

FORTISAN* 36 RAYON FIBER
makes these products STRONGER



V-BELTS. These vital power transmitters gain extra life when reinforced with Celanese FORTISAN-36. After extra long wear stretch is negligible. It won't expand or contract under normal V-Belt operating conditions so as to affect the belt's efficiency. This is because it's dimensionally stable. FORTISAN-36 is far stronger than conventional fibers, imparts higher tensile strength. That's why V-belts with FORTISAN-36 are now being used as original equipment on automatic washers, power mowers, trucks, passenger cars and farm tractors.

HIGH-PRESSURE FIRE HOSE. Used as filler cord in interior and exterior jackets of high-pressure fire hose, FORTISAN-36 pays off in a lighter but stronger hose that's more flexible, easier to handle and rack, and more heat-resistant. Also, it saves space because it folds tighter. FORTISAN-36 saves money in processing since it need not be heat-stretched.

HIGH-PRESSURE HOSE. High tensile strength, remarkable stretch-resistance and nearly perfect dimensional stability make FORTISAN-36 first choice for many types of high pressure hose. It produces a hose that's lighter, safer, more flexible and capable of taking extreme pressures easily. Hose of FORTISAN-36 appear likely to do a better job in aircraft controls, hydraulic presses, power feeds, trucks, greasing tools, road-building equipment.

FORTISAN-36 IS GOING PLACES! Besides these applications, this new Celanese high-tenacity, heavy-duty rayon of saponified acetate has practical application for truck tires, plastic laminates, filters, paper reinforcement, tarpaulins and webbing. Let us show you how it can improve your product. Write for booklet TD20A to Celanese Corporation of America, Industrial Sales Dept., Textile Division, Charlotte, N. C. Branch offices: 180 Madison Ave., N. Y. 16; Pilgrim Sq. Building, 9 Overwood Rd. at W. Market St., Akron 13, Ohio (Tel.: TE 6-2392). *Reg. U.S. Pat. Off.

Celanese

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For the Best in Rubber and Plastics...

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Muehlstein offers complete grinding facilities and strict laboratory control for hard rubber dust – manufactured and ground to your specifications. You have your choice of all standard grades regularly available. Don't forget, too, Muehlstein offers you a complete technical service with modern, newly-expanded laboratory facilities ready to help solve your manufacturing problems.

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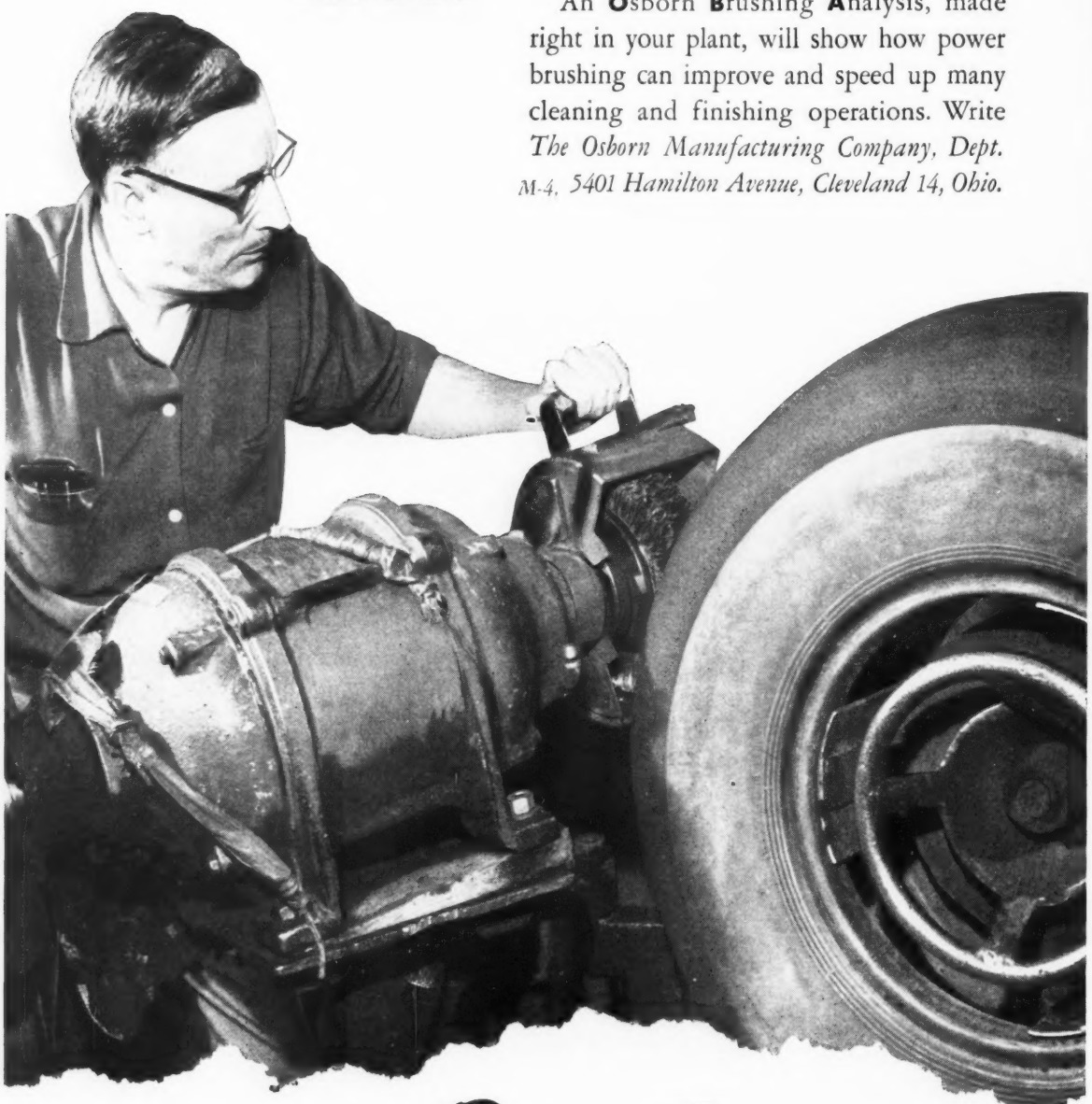
OSBORN brushing methods simplify and improve the preparation of worn, heavy-duty tire casings for retread.

As the casing revolves on its holder, a special 12″ Osborn wire brush chews away all old, worn rubber . . . leaves the evenly roughened, uniform surface essential to a good recapping.

An **O**sborn **B**rushing **A**nalysis, made right in your plant, will show how power brushing can improve and speed up many cleaning and finishing operations. Write *The Osborn Manufacturing Company, Dept. M-4, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

We Proudly Present

THE NEWEST NAME IN SYNTHETIC RUBBER

FR-S

(FIRESTONE RUBBER - SYNTHETIC)

Made Only By

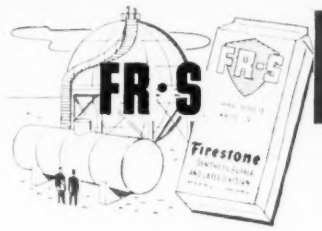
Firestone

The World's Largest Rubber Producer

A new era is here—and with it comes a new name for a greatly improved rubber! More than just a new name, FR-S is Firestone's new HIGH STANDARD of synthetic rubber . . . already tested and proved . . . and now in large scale use in Firestone's own manufacturing operations.

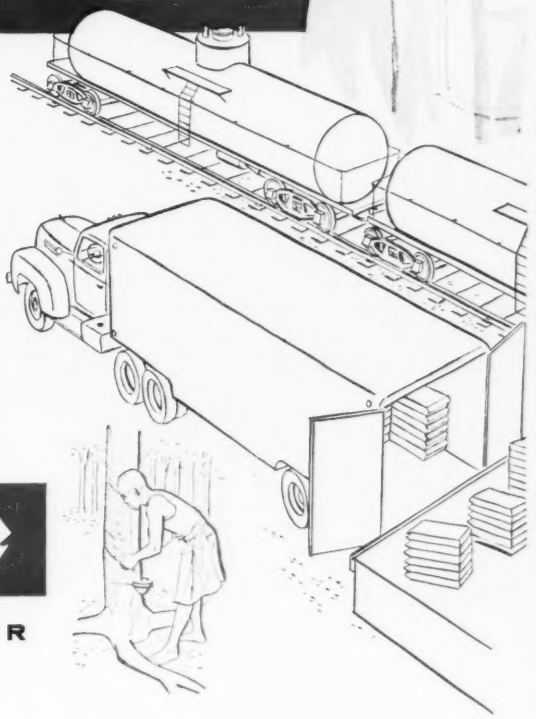
During the past year, every phase of Firestone's synthetic rubber manufacturing has been modernized. Raw materials must meet new, HIGHER STANDARDS. New, improved techniques; new measuring devices, and scientific methods of control have been added as plant capacity has been expanded.

FR-S is available in latex or dry rubber . . . in drums or tank car . . . bales or carload quantities. A Firestone Technical man will be glad to give you further information on FR-S and its applications. Phone or write Firestone, Synthetic Rubber and Latex Division, Akron, Ohio.

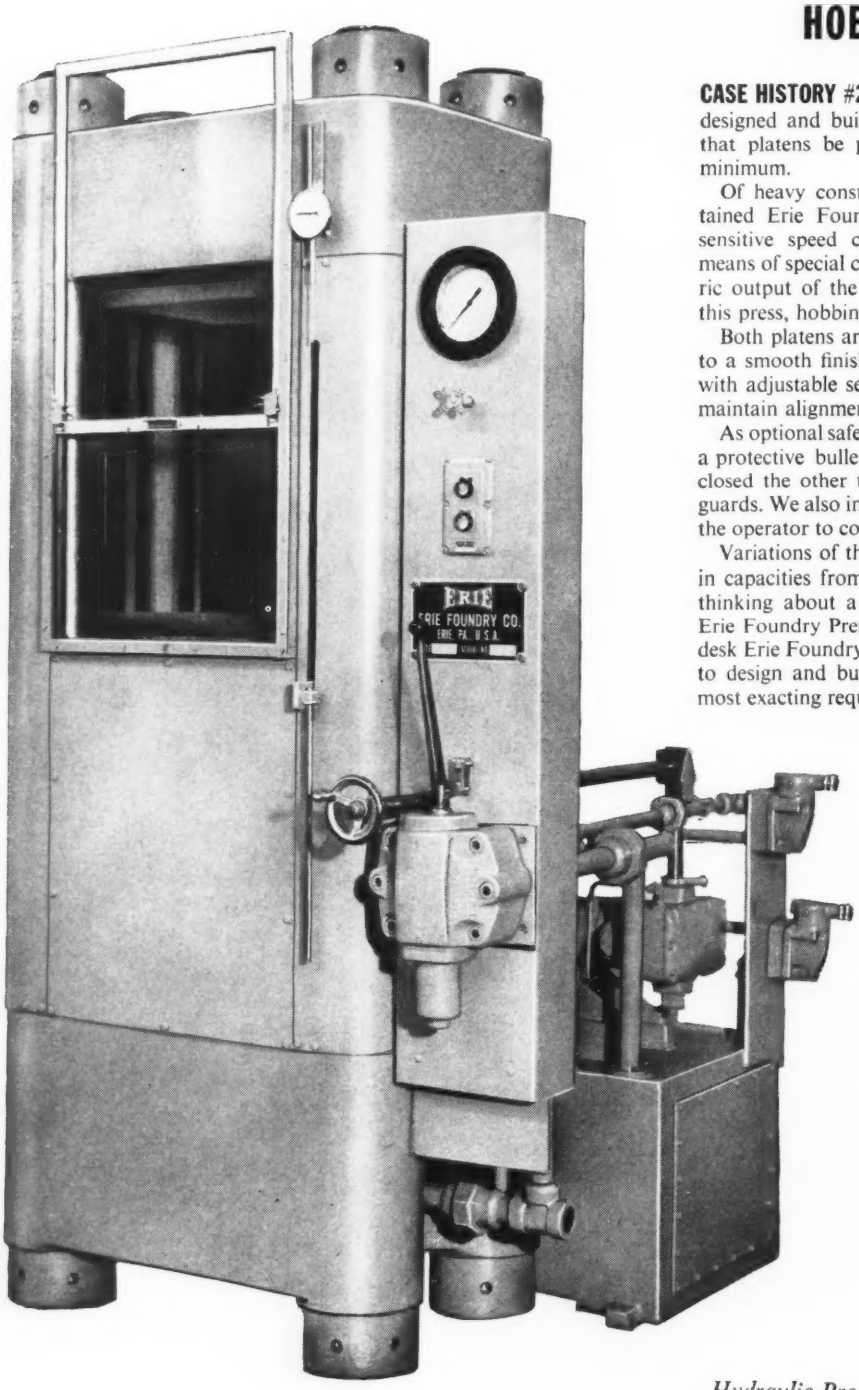


Firestone

BEST IN RUBBER



ERIE PRESS OF THE MONTH



HOBBING PRESS

CASE HISTORY #2—This 500 ton Hobbing Press was designed and built for a customer who demanded that platens be parallel and deflection kept to a minimum.

Of heavy construction throughout, the self-contained Erie Foundry Hobbing Press achieves the sensitive speed control essential for hobbing by means of special controls which change the volumetric output of the pump under load (pressure). On this press, hobbing is a smooth, sensitive operation.

Both platens are accurately machined and ground to a smooth finish and the ram platen is equipped with adjustable semi-steel guides on each corner to maintain alignment.

As optional safety equipment, Erie Foundry added a protective bullet-proof glass sliding door and enclosed the other three sides of the press with steel guards. We also installed a depth gauge which allows the operator to control each hob accurately.

Variations of this hobbing press can be furnished in capacities from 200 ton to 3000 ton. If you are thinking about a new hydraulic press, call in the Erie Foundry Press Engineer. He will bring to your desk Erie Foundry Company's experience and ability to design and build a press which will meet your most exacting requirements.

ERIE

SINCE 1895

Hydraulic Press Division

ERIE FOUNDRY CO. ERIE, PA.

Here they are: Three new, nonstaining,

of properties and costs, ideally su

Plioflex 1006

– a hot, nonextended, styrene rubber

Pliofl

– a cold, oil ma
naphthenic oi

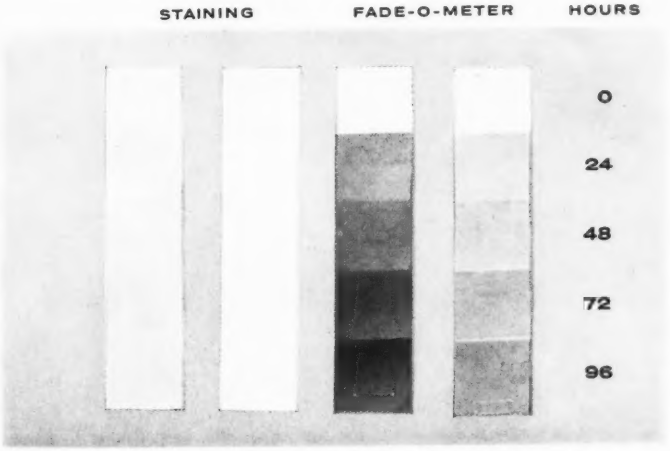
Here's how they compa

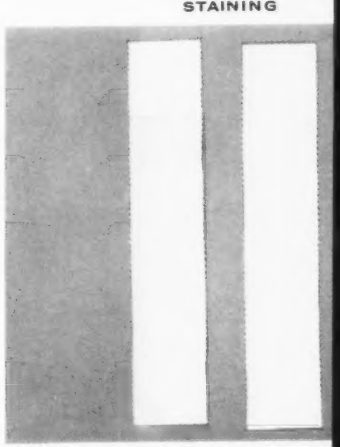
story of the color improve

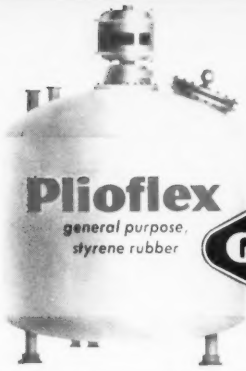
GR-S 1006 PLIOFLEX 1006

GR-S 1703 PLIOFLE

Here's proof of color s







CHEMICAL
GOODYEAR
DIVISION

nondiscoloring rubbers in a range
uited for light-colored applications:

ex 1773

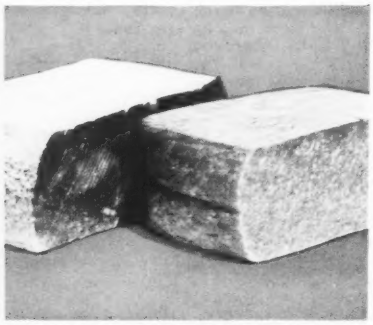
sterbatch (25 pts.
), styrene rubber

Plioflex 1778

– a cold, oil masterbatch (37.5 pts.
naphthenic oil), styrene rubber

re:

Unretouched, four-color photographs vividly tell the
ment in the new PLIOFLEX rubbers over their predecessors:

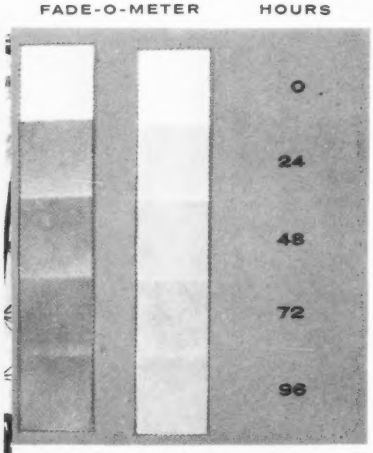


: 1703 PLIOFLEX 1773

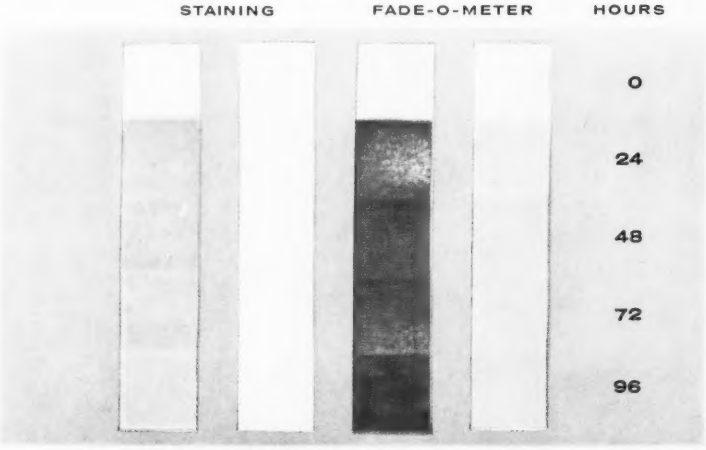
GR-S 1710 PLIOFLEX 1710 PLIOFLEX 1778

tability:

Results of prolonged exposures to ultraviolet light graphically illustrate the ability of the new PLIOFLEX rubbers to resist staining and color change:



PLIOFLEX 1703 PLIOFLEX 1773



PLIOFLEX 1710 PLIOFLEX 1778 PLIOFLEX 1710 PLIOFLEX 1778

IMPORTANT NEWS FOR
ALL RUBBER PROCESSORS:

Goodyear
(CHEMICAL DIVISION)

makes available
(in commercial quantities)

three new
(amazingly light-colored)

types of Plioflex
(general purpose, styrene rubber)

WHAT'S IN BACK OF THE NEW PLIOFLEX RUBBERS–

The story behind the new PLIOFLEX rubbers stretches back to the 1920's. It was then Goodyear first engaged in research in synthetic rubber which, through the years, resulted in a number of notable advances in the production and use of man-made elastomers.

The current chapter of the PLIOFLEX story began in April, 1955, when Goodyear acquired former, government-owned, synthetic rubber plants at Houston, Texas, and Akron, Ohio. Recognizing its responsibility to the industry, Goodyear immediately began to expand its research and production facilities. The new PLIOFLEX rubbers are among the first results of these increased efforts.

These new PLIOFLEX rubbers – a result of improved manufacturing techniques and use of new, improved raw materials–constitute a major improvement over their predecessors. However, they may also be considered as but forerunners of even greater improvements to come.

WHAT LIES AHEAD FOR THE PLIOFLEX RUBBERS–

First – and foremost in light of the recent supply situation – production facilities are being rapidly and substantially expanded to meet the ever-increasing demand for high quality synthetic rubber.

Second – Goodyear will continue to maintain a research and development program of a nature and scope to keep its products – and yours – in the vanguard of technical progress.

Third – the sale of present and future PLIOFLEX rubbers is and will be accompanied by a type of service not previously associated with synthetic rubber. In addition to increased research and production efforts, sales staffs, service laboratories and operating departments have been expanded and strengthened to give all the service desired by customers both large and small.

WHAT THIS MEANS TO YOU–

Simply stated, it means you will be getting all the highest quality synthetic rubber–PLIOFLEX– you may want, as you want it, when you want it and with all the assistance you may need.

WHAT TO DO ABOUT IT–

Write today for full details on the new PLIOFLEX rubbers and/or related products of interest to the rubber industry:
Address: Goodyear, Chemical Division,
Akron 16, Ohio.

CHEMICAL
GOODYEAR
DIVISION

Chemigum, Plioflex, Pliolite, Plio-Tuf, Pliovic – T. M.'s
The Goodyear Tire & Rubber Company, Akron, Ohio

RUBBER &
RUBBER CHEMICALS DEPARTMENT

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIO-TUF • PLIOVIC • WING-CHEMICALS
High Polymer Resins, Rubbers, Latices and Related Chemicals for the Process Industries

In high-pressure mixing, all of the batch, with the possible exception of the oils, is put into the Banbury mixer at one time. Then the weight on the batch is brought down quickly, with pressures approximately three times normal. This produces high-horsepower conditions of short duration, applying maximum work to the compound while it is the stiffest and offers the greatest resistance to shear.

The pros and cons of high-pressure mixing

Both from field experience and laboratory tests, this technique appears to be most effective on tougher compounds—including tire stocks, high-tensile mechanicals, shoe heel and sole compounds and floor tile. Equal cycle reductions apparently can not be obtained on softer stocks.

Using a size 11, high-pressure Banbury mixer, built for operation at 40 RPM, and having a large diameter floating-weight cylinder and 800 or 1000 HP driving motor, overall cycle time to produce tread masterbatch has been substantially reduced; in some cases more than 50 per cent with an actual mixing period as short as two minutes.

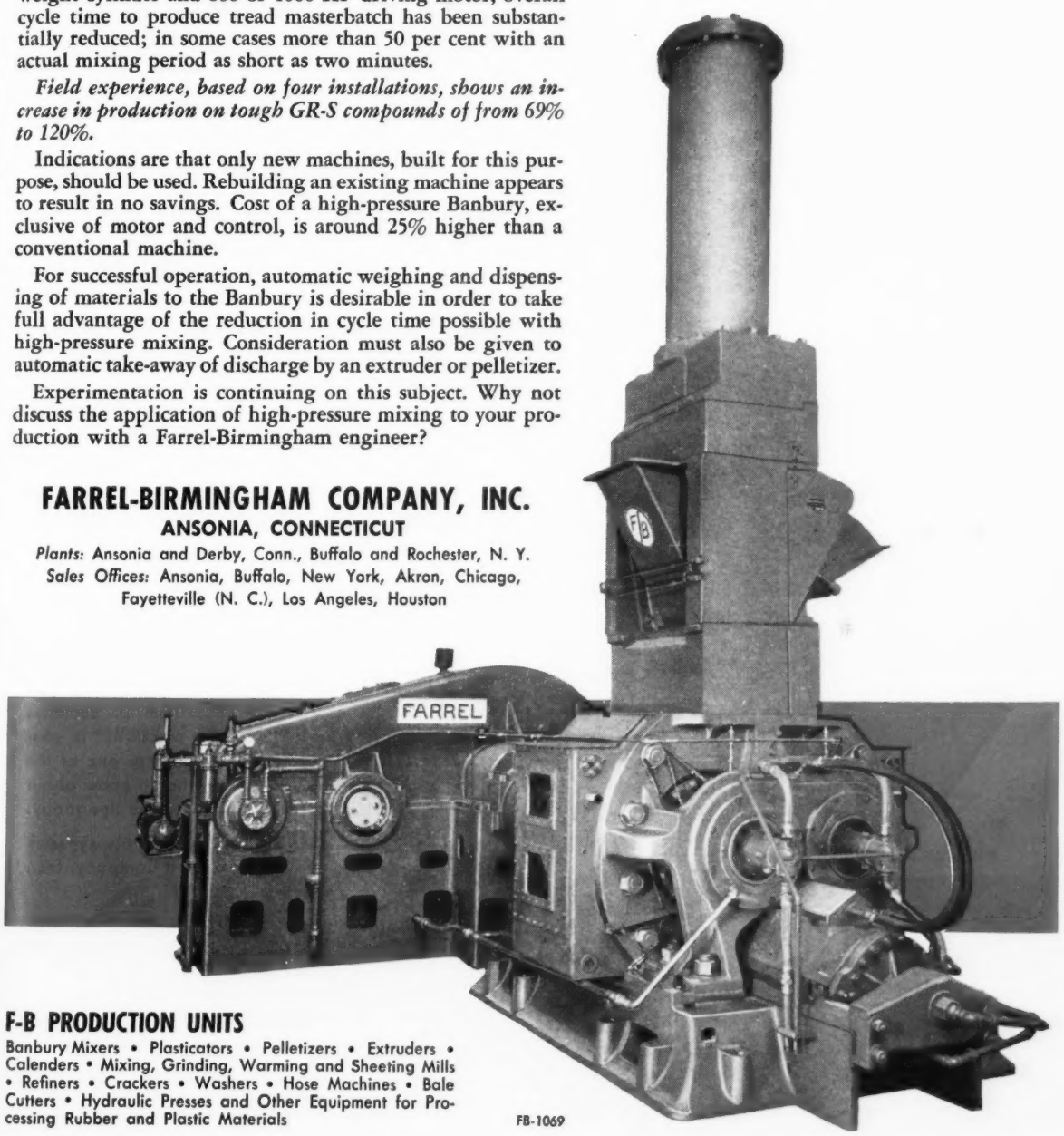
Field experience, based on four installations, shows an increase in production on tough GR-S compounds of from 69% to 120%.

Indications are that only new machines, built for this purpose, should be used. Rebuilding an existing machine appears to result in no savings. Cost of a high-pressure Banbury, exclusive of motor and control, is around 25% higher than a conventional machine.

For successful operation, automatic weighing and dispensing of materials to the Banbury is desirable in order to take full advantage of the reduction in cycle time possible with high-pressure mixing. Consideration must also be given to automatic take-away of discharge by an extruder or pelletizer.

Experimentation is continuing on this subject. Why not discuss the application of high-pressure mixing to your production with a Farrel-Birmingham engineer?

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Akron, Chicago, Fayetteville (N. C.), Los Angeles, Houston



F-B PRODUCTION UNITS
Banbury Mixers • Plasticators • Pelletizers • Extruders • Calenders • Mixing, Grinding, Warming and Sheeting Mills • Refiners • Crackers • Washers • Hose Machines • Bale Cutters • Hydraulic Presses and Other Equipment for Processing Rubber and Plastic Materials

FB-1069

YOUR CUT COSTS ON *Tread Rubber*

(CAMELBACK)

. . . with new

RECLAIMATOR
(PATENTED)
RECLAIMS

"Quality is maintained" say manufacturers of tread rubber who use RECLAIMATOR Reclaims in their compounds for EASIER and FASTER processing at LOWER COST.

These Reclaims are ideal for use with natural and/or synthetic rubber. Their low Mooney plasticity means easier processing, shorter mixing time and faster extrusion. In addition RECLAIMATOR Reclaims lend greater residual tack to your stock bank and shelf goods. All this adds up to LOWER COMPOUND COSTS and HIGHER PROFITS!

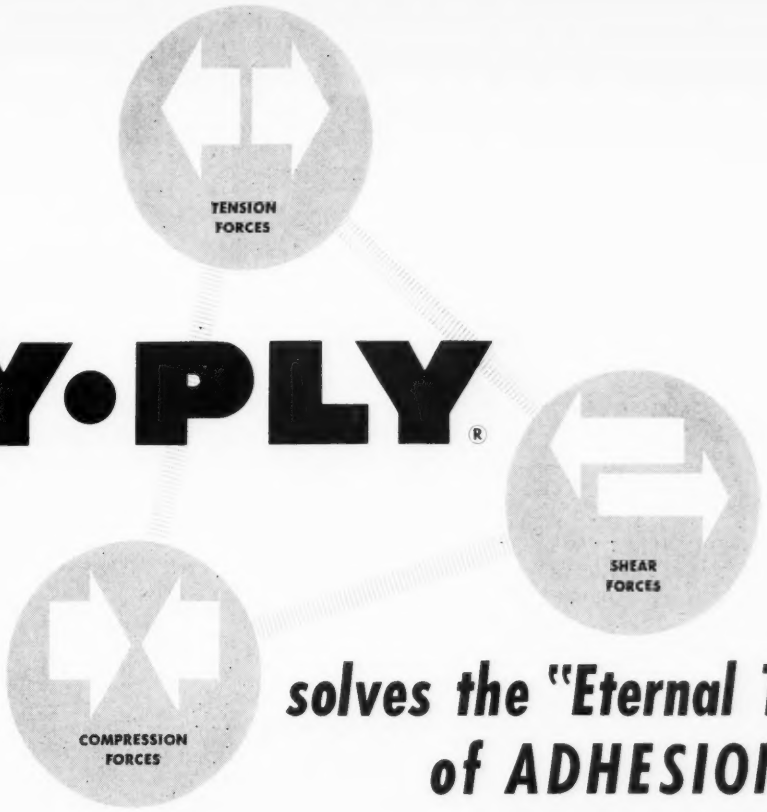
The exclusive short cycle process of RECLAIMATOR Reclaims retains MORE of the original properties of RUBBER in your formula. Whether you make tread rubber or one of the hundreds of other rubber products, you should know about these new money-saving reclaims. Drop us a line today.

Always keep reclaims in your formula and always look to US for the best. U.S. Rubber Reclaiming Company, Inc., P.O. Box 365, Buffalo 5, N. Y.

Trenton Agent:
H. M. Royal, Inc., 689 Pennington Ave., Trenton, N. J.

73 Years Serving the Industry Solely as Reclaimers

U.S. RUBBER RECLAIMING COMPANY, INC.
P. O. BOX 365 BUFFALO 5, N. Y.



TY•PLY®

solves the "Eternal Triangle" of ADHESION

TY-PLY...the RUBBER-to-METAL ADHESIVE *that bonds for a lifetime*

Recommended for the severest of Static, Dynamic, and Chemical Resistance Requirements!

TY-PLY is the ideal choice for vulcanized bonding of rubbers to metals under varying process conditions. Recommended and used for the widest variety of rubber-bonded units to meet the toughest of static, dynamic, and chemical resistance requirements.

TY-PLY "UP-BC"
two-coat Adhesive System for bonding of Butyl Rubbers.

TY-PLY "UP-RC"
two-coat Adhesive System for bonding Natural Rubber and GR-S Compounds.

TY-PLY "Q" or "3640"
the single coat Adhesive for bonding Natural and GR-S Compounds.

TY-PLY "BN"
for bonding N-types

TY-PLY "S"
for bonding Neoprene

TY-PLY will adhere most vulcanizable rubber compounds to almost any clean metal surface

Marbon®

MARBON CHEMICAL
Division of BORG-WARNER
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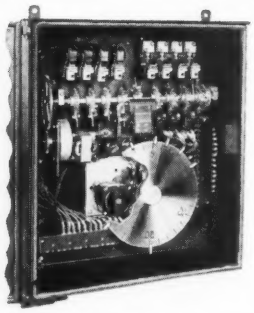
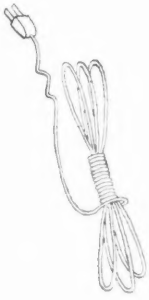
TY-PLY has stood the test of time . . . since '39

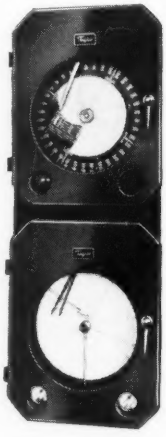
These TAYLOR CONTROLS



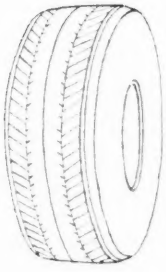


The new Taylor FLEX-O-TIMER* Timed Program Controller gives greater precision than ever to the timing and coordination of automatic presses used for vulcanizing tires or any mechanical goods. Actuates switches, turns valves, and performs many other operations involving temperature, pressure, mechanical motion, electrical energy or any combinations of these.

can save you money

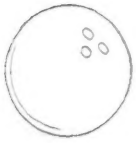


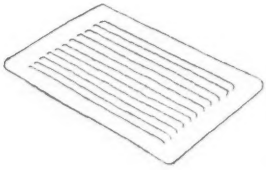
Taylor's FULSCOPE* Time-Schedule controller will repeat exactly any predetermined program involving temperature, pressure, flow or level, or any two of these. It controls rate of rise, hold periods, and rate of fall, in any desired sequence. Ideally suited for any type of vulcanizer.

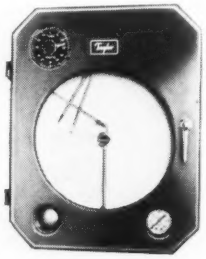


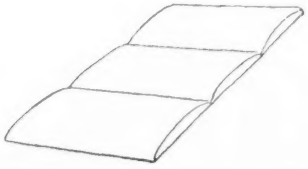
making most any Rubber Product!

Taylor's FULSCOPE Temperature Controller with Process Timing mechanism controls temperature and curing time of cycle. Automatic timing does not start until set temperature is reached. Needs no manual attention until signal light announces completion of vulcanizing cycle. Ask your Taylor Field Engineer, or write: Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.









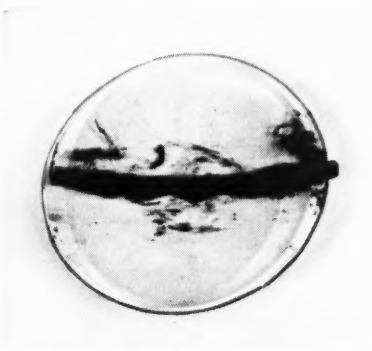
Instruments for indicating, recording and controlling temperature, pressure, flow, liquid level, speed, density, load and humidity.

*Reg. U.S. Pat. Off.

TAYLOR INSTRUMENTS MEAN ACCURACY FIRST

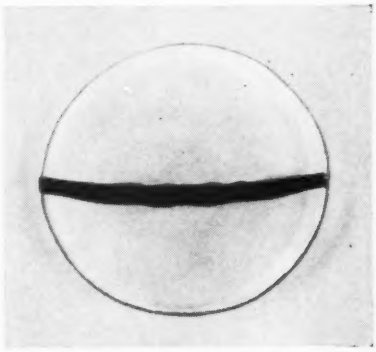
KEL-F® ELASTOMER
IS SHATTERING IDEAS ABOUT RUBBER

Challenging new fluorocarbon rubber has outstanding...
CHEMICAL RESISTANCE...HEAT RESISTANCE

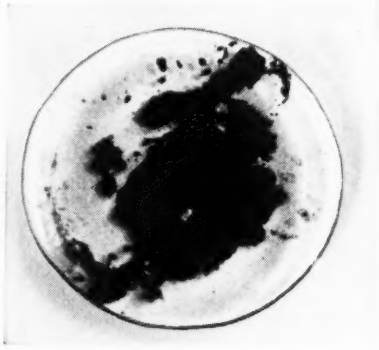


BUNA-N—10 min. immersion in RFNA

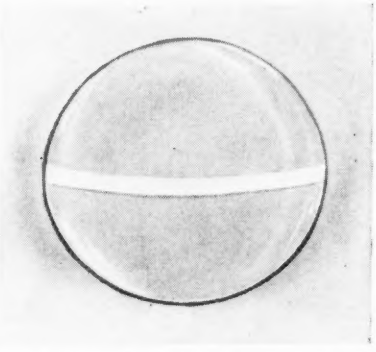
NATURAL RUBBER—10 min. immersion in RFNA



BUTYL—2 hr. immersion in RFNA



GRS—10 min. immersion in RFNA



KEL-F ELASTOMER—one week immersion in RFNA

IMMERSION IN RED FUMING NITRIC ACID for one week has no appreciable effect on the physical properties of KEL-F Elastomer. Extensibility and hardness remain virtually unchanged. Other available rubbers disintegrate within a matter of minutes.

When severe operating conditions demand a chemical rubber that *must* stand up under high temperatures and corrosive atmospheres—KEL-F Elastomer is the answer.

Developed by Kellogg, KEL-F fluorocarbon rubber combines superior elastomeric properties with excellent chemical resistance and thermal stability. Other outstanding advantages include: high chemical resistance to solvents, fuels and lubricants . . . low moisture absorption . . . non-flammability . . . excellent resistance to weathering and microorganisms.

This *unique* combination of properties makes KEL-F Elastomer useful in applications such as heat-and-chemical-resistant hose, tubing, diaphragms, gaskets, seals, tank linings, corrosion-resistant clothing, paints, flame-resistant coatings, and electrical insulation.

If your work requires an elastomer with outstanding resistance to heat and corrosion, look into KEL-F Elastomer. Our technical staff is prepared to assist designers, engineers, and production men in adapting KEL-F Elastomer to their individual needs. Kellogg supplies KEL-F Elastomer in the gum form only. Names of qualified fabricators of specific end uses of KEL-F Elastomer are available on request.

HOT OFF THE PRESS! *Our newly published booklet, "KEL-F Elastomer," is yours for the asking. Just fill out and mail coupon below for your free copy.*

®KEL-F is the registered trademark of The M. W. Kellogg Company for its fluorocarbon products.

KELLOGG

THE M. W. KELLOGG COMPANY
Subsidiary of Pullman Incorporated
Chemical Manufacturing Division
P. O. Box 469, Jersey City, N. J.

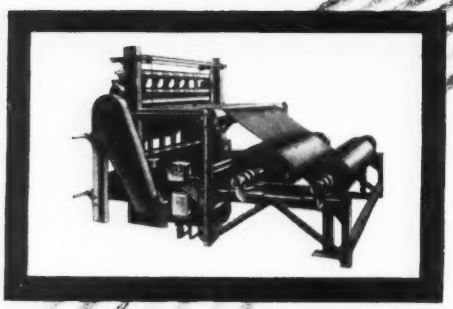
Send me a copy of your new booklet, "KEL-F ELASTOMER."

Name_____

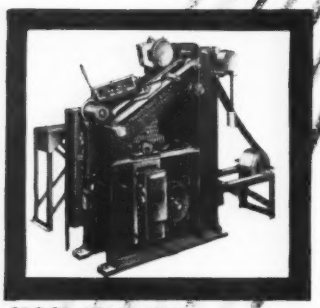
Firm_____ Position_____

Address_____

City_____ Zone_____ State_____

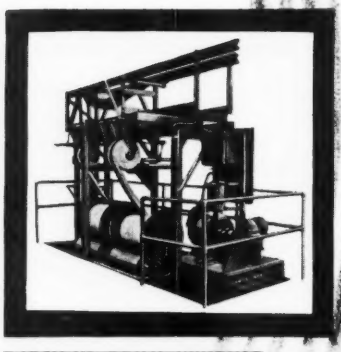


FABRIC SLITTING
at 450 yards an hour



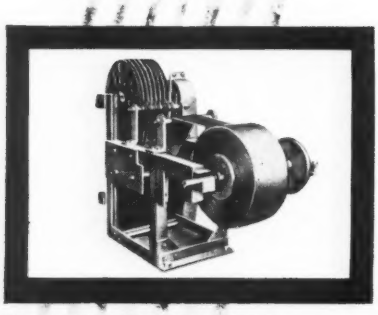
SPOOL WRAPPING
to supply 4 Monoband machines

complete wire-bead CYCLE TYRES in one fast operation

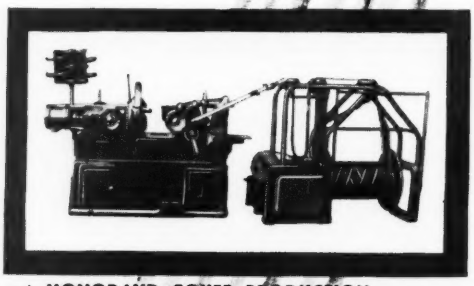


BATCH-UP DRUM WINDING
for continuous production

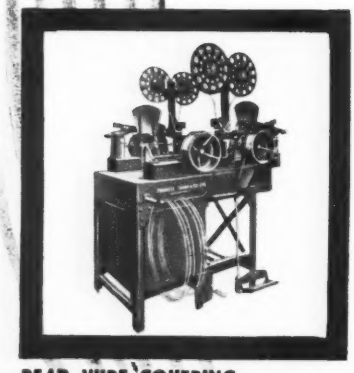
SHAW
MONOBAND PROCESS



BEAD WIRE FABRIC SLITTING
for 1,650 tyres an hour



and **MONOBAND COVER PRODUCTION**
of up to 80 covers an hour



BEAD WIRE COVERING
of 300 single wires an hour

with the SHAW-SUMMIT vulcanising press

SHAW

FRANCIS SHAW & CO LTD MANCHESTER 11 ENGLAND
TELEX 66-357
Enquiries to:
FRANCIS SHAW (CANADA) LTD GRAHAMS LANE BURLINGTON ONTARIO CANADA
TELEPHONE NELSON 4-2250 TELEGRAMS CALENDER BURLINGTON ONTARIO

Citrus aurantium.
The "orange" . . . proud product of the West, and one of the most important food crops in the world.

SYNTHETIC RUBBER

is a product of the West, too!

When you need rubber for sheeting, molded or extruded goods, tires or other uses—Shell Chemical is your convenient source West of the Rockies.

The Shell Chemical plant at Torrance, California, is one of the nation's best-equipped for the production of butadiene-styrene types of rubber. Convenient location and diversity of product make Shell Chemical your *logical* source in the West.

When you encounter troublesome technical problems—remember that the Shell Technical Service Laboratory will help you find practical solutions.

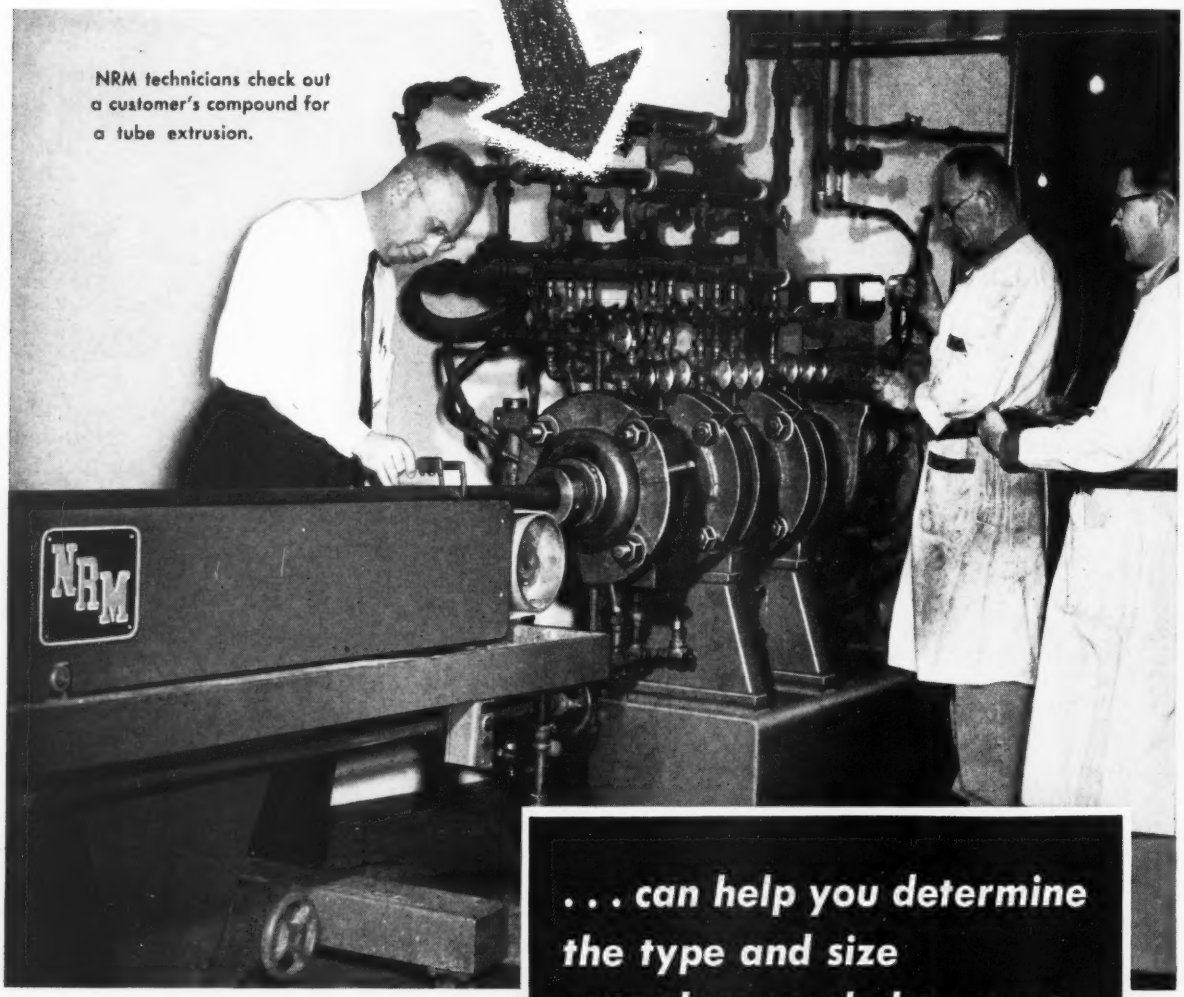
Next time you need synthetic rubber—write or call *Torrance, California.*

SHELL CHEMICAL CORPORATION
Synthetic Rubber Sales Division
P. O. Box 216, Torrance, California

SHELL

NRM RUBBER EXTRUDER

This special

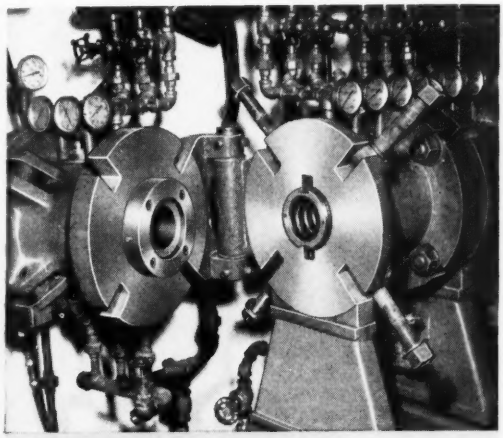


NRM technicians check out a customer's compound for a tube extrusion.

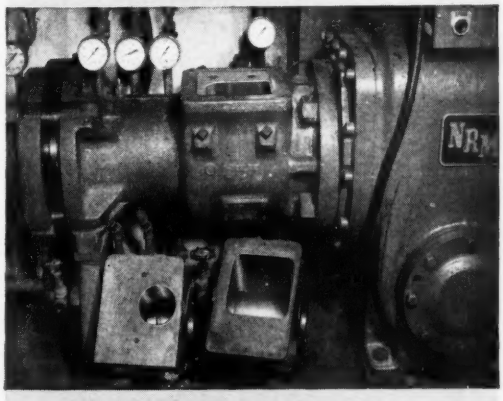
. . . can help you determine the type and size extruders needed to meet your rubber production requirements EXACTLY . . .

2504

It is a part of MANY laboratory facilities we maintain to assure our customers more efficient, more profitable rubber production with . . .



Compounds are tested under several extruder variations to determine the best production condition. Two hinged cylinder sections attached to the base section of the laboratory extruder provide for one, two or three times the cylinder length of a standard rubber extruder. Here, combination smooth-bore and Mil-X-Truder® Liners are being used.



Best method of feeding compounds are also determined. The interchangeable feed boxes shown here are: side feed undercut, for strip feeding (installed), round center feed for powder or pellets (lower left), and at lower right, oblong center feed for crumb or chunk.

NRM EXTRUDERS

What type and size extruder should you buy to produce your rubber compounds most economically? What screw length and type is most suited to your extrusion requirements? Should the machine be equipped with smooth-bore, or fluted cylinder liners?

If you are planning to purchase rubber extruders, you'll want answers to these and other questions, and you'll want them *before* you buy.

You can get these answers at NRM.

We maintain extensive laboratory facilities which have two main functions: one, to help *us* make sure the extruders we build are of most practical design, and two, to help *you* make sure the NRM Extruders you buy are properly selected (and properly equipped) for the range of work they are to do. Even after the right extruder has been determined, NRM field engineers "follow up" on its installation to make sure the customer gets *all* the performance inherent in the machine. We make these laboratory facilities and this field service available to the rubber industry, and invite you to take advantage of them to help solve your particular extrusion problems.

The specially designed rubber extruder shown on the opposite page is an important part of these laboratory facilities. With it we can test not only the extrudability of your standard or special compounds, but determine exactly the type of machine required to extrude them. It is equipped for devolatilizing wet compounds, and extruding compounds by oil injection. It can be water cooled, or heated by steam or oil. It can be converted quickly from a short to a long machine, with either machine having smooth-bore cylinder, Mil-X-Truder® Liners, or combination of both. It can use any of several NRM feed screws, and feed boxes may be interchanged to permit a variety of feeding methods. In effect, the machine provides *all* extruder variations necessary for testing any rubber compound under various production conditions.

This extruder—and our entire laboratory facilities—are available to help develop and test your rubber compounds, and determine *exactly* the NRM Extrusion Equipment needed to produce them economically. We invite you to take advantage of these facilities. Call us about it today.

NATIONAL RUBBER MACHINERY COMPANY

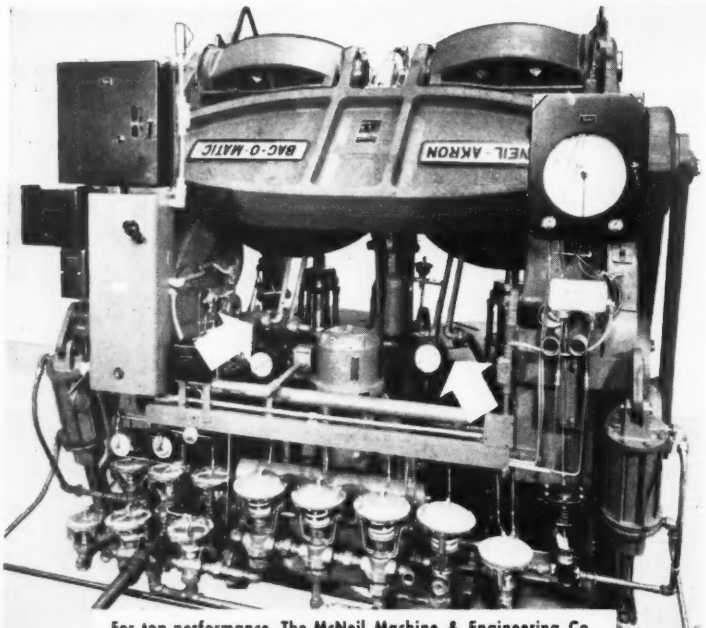
NRM

Creative Engineering

General Offices and Engineering Laboratories: 47 West Exchange St., Akron 8, Ohio
EAST: Plants at Akron and Columbiana, Ohio and Clifton, N. J.
WEST: Western Sales: S. M. Kipp, Box 441, Pasadena 18, Cal.
MID-WEST: W. G. Potts, 5875 N. Lincoln Ave., Chicago 5, Ill.
EXPORT: Gillespie & Company, 96 Wall St., New York 6, N. Y.

2504

SELF-ALIGNING **BARCO** SWIVEL JOINTS



For top performance, The McNeil Machine & Engineering Co., Akron, Ohio, uses Barco Swivel Joints to make flexible piping connections on this twin platen McNeil Bag-O-Matic press and for water bag connections on other types of tire curing.

Read What Users Say:

- "Joints last 3 or 4 times longer than other methods of providing flexibility —with no maintenance required."
- "With Barco Joints and the new 11CTS gaskets we handle alternating steam and cold water without leakage."
- "Barco Joints on our platen presses *don't get in the way* like non-rigid lines. They permit *accurate temperature control too.*"
- "We're interested in *safety and avoiding shut downs.* Your joints *don't break or fail suddenly.*"
- "Your self-alignment feature makes *installation easy.*"
- "We like your joints because they require so little maintenance. We don't even have to lubricate them."

How Improved Barco Swivel Joints Make Tire Molds, Presses Work Better

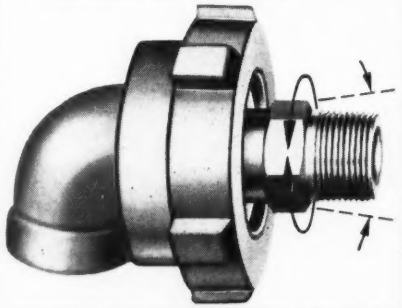
DEPENDABLE, TROUBLE-FREE PERFORMANCE —time after time—has been the one big reason for using Barco Swivel Joints in flexible piping connections and dog-legs on tire molds and platen presses used in the rubber industry. And now Barco offers even *better* performance and service, not only for new uses, but for thousands of existing installations.

The ANSWER is Barco's new, chemically inert No. 11 CTS gasket. No other material is as amazingly long wearing and versatile. Even under most adverse conditions, joints maintain their seal, hot or cold, working or idle—with lower torque and no lubrication required. Natural operating action keeps the hemispherical ball of the joint lapped to a perfect fit.

Get this advanced performance in new Barco Swivel Joints! Send for complete information on MODERNIZING old joints!

USED BY LEADING MACHINE BUILDERS

- **IMPROVED SEAL**—Barco's new No. 11CTS gasket is amazingly long wearing! Does not bake hard. Ideal for steam and water service. Does not cause excess wear on other parts.
- **LEAKPROOF, HOT OR COLD** — Joints stay tight regardless of pressure or temperature.
- **SELF-ALIGNING**—10° side flexibility. This Barco feature saves piping time, cuts costs, and insures perfect performance.
- **ENGINEERING RECOMMENDATIONS**— Send for a copy of Catalog No. 265A and installation drawing 10-52004.



BARCO MANUFACTURING CO. BARCO **510F Hough Street, Barrington, Illinois**

GEN-TAC®

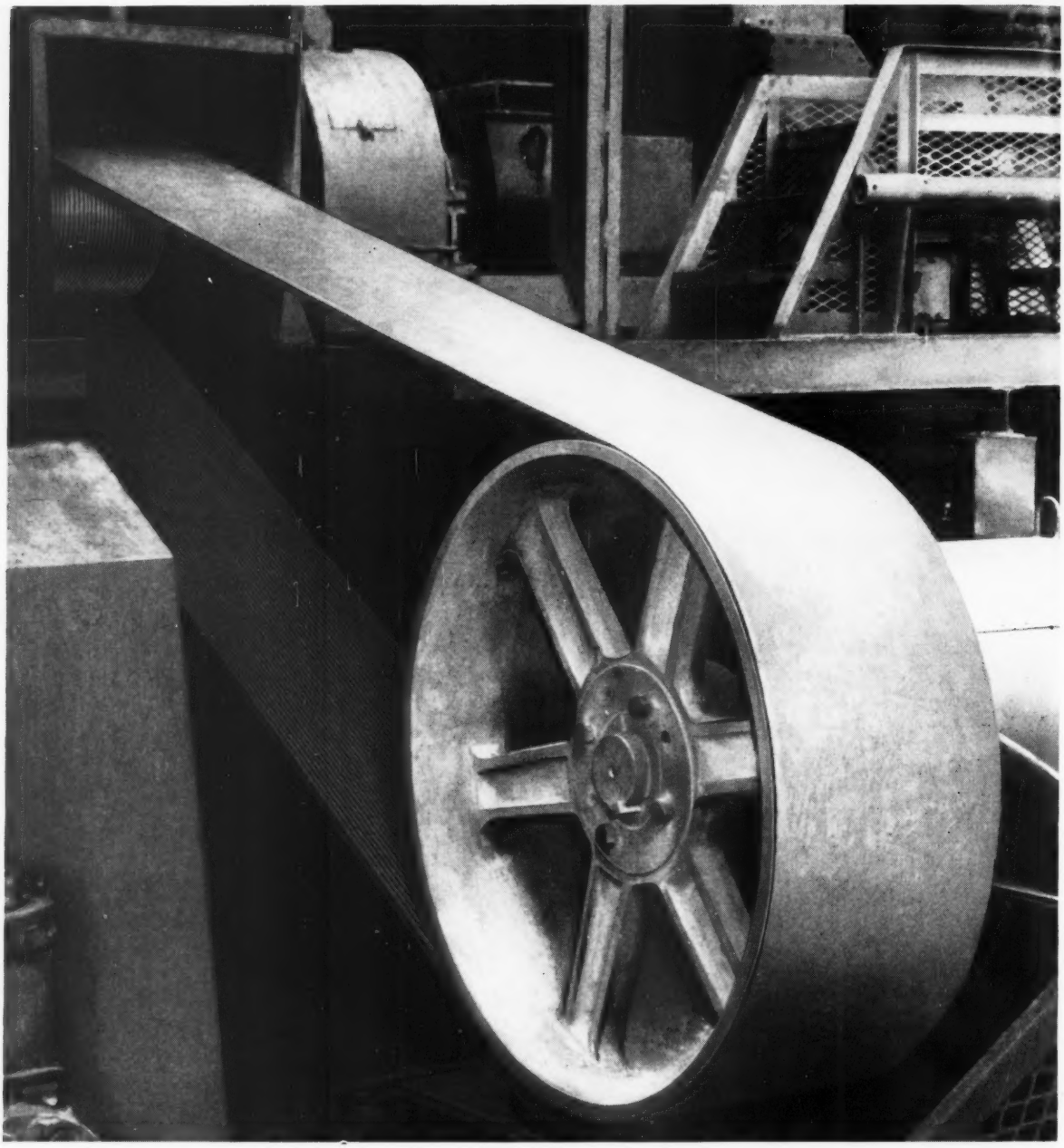
helps to prevent "Curing Blows" like this!

Curing blows are a familiar and costly sight in some factories. Gen-Tac cuts these losses to a minimum, because it is fast curing and develops its strength in the early stages of cure when internal pressures do the most harm.

Gen-Tac Vinyl Pyridine Latex is another "Industry-proven" product of the Chemical Division of The General Tire & Rubber Company, Akron, Ohio.

THE GENERAL TIRE & RUBBER COMPANY
Chemical Division, Akron, Ohio

Chemical Division
GENERAL
THE GENERAL TIRE & RUBBER CO.
GEN-TAC



A GRIPPING SITUATION – This unique, multi-ribbed Poly V® Belt drives a 900 HP oil field pump for a West Texas drilling rig. Manufactured by Raybestos-Manhattan, Inc., its single-unit construction eliminates "matching" problems; provides excellent grip and positive tracking wherever heavy-duty power transmission is required. Because great lateral strength, crack-resistance and body are required in its manufacturing, Raybestos-Manhattan turned to Mount Vernon Mills, Inc. for a top cover fabric.

This is another example of how fabrics made by Mount Vernon Mills, Inc., and the industries they serve, are serving America. Mount Vernon Mills, Inc. engineers and its laboratory facilities are available to help you in the development of any new industrial fabric or in the application of those already available.

UNIFORMITY
Makes The Big
Difference
In Industrial Fabrics

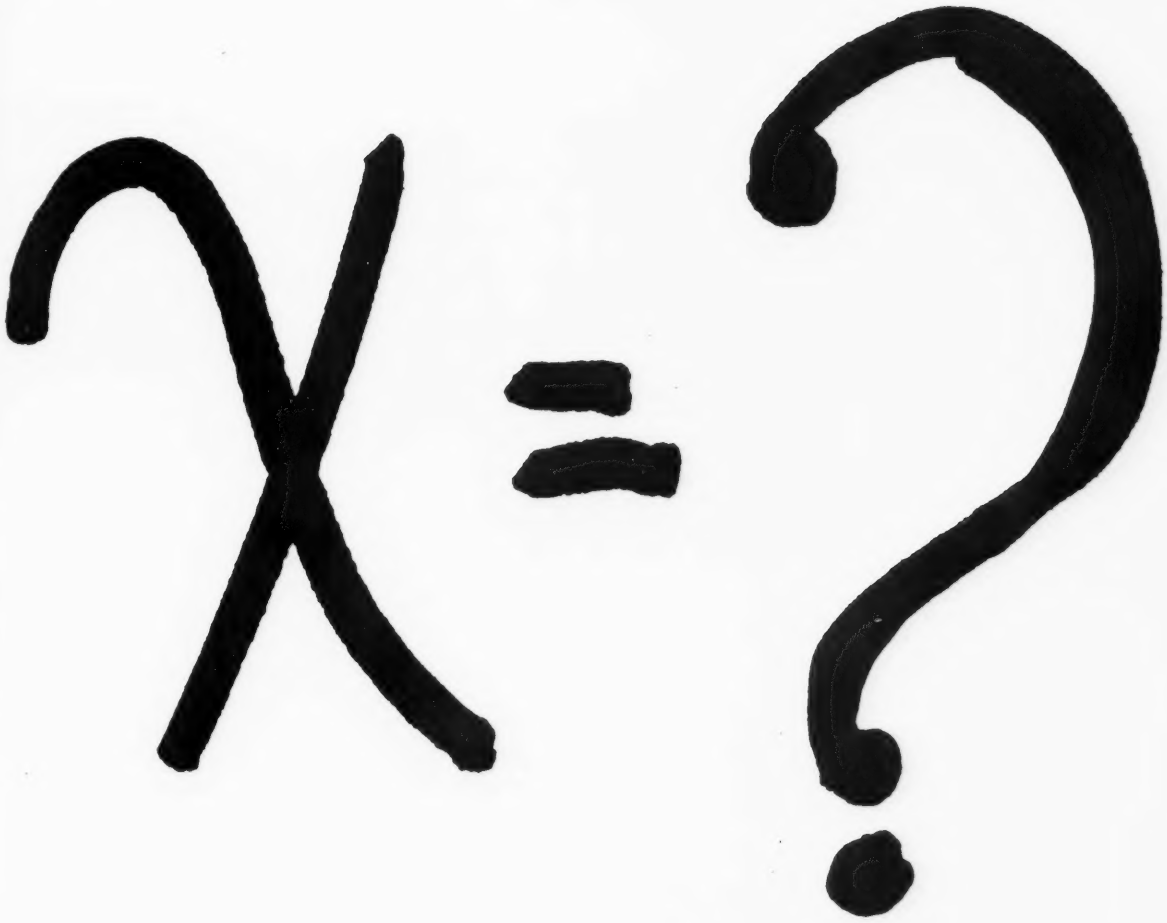
Mount Vernon Mills, Inc.

A LEADER IN INDUSTRIAL TEXTILES

TURNER HALSEY
COMPANY
Selling Agents

Main Offices: 40 Worth Street, New York, N. Y.

Branch Offices: Chicago • Atlanta • Baltimore • Boston • Los Angeles



Answering Questions About Rubber Formulations Is Our Business

Sometimes the answers are so simple, we are surprised ourselves! Like the time a certain rubber processor brought us this one:

The Problem: What is the best non-staining antioxidant for a 55 Durometer natural rubber stock with a heavy whiting load?

Here's What Monsanto Compounders Did: Compounded a pale crepe stock with 100 parts of whiting . . . added Santowhite Crystals and also test batches including two other good commercial antioxidants.

The Results: Formulation with Santowhite Crystals showed best aging by a wide margin.

Better performance is the only way we sell. Sure, our crystals and powders are pure and pretty. But customers buy our rubber chemicals because they work not only in the laboratory, but on the production line.

Be your tonnage large or not-so-large, ask your questions anyhow. Unless your problem is so unique that it stumps the experts, the answer might require no more than riffling through the index of the more than 18,000 lab reports in our files. *Monsanto Chemical Company, Rubber Chemicals Dept. RC-1, (telephone HEmlock 4-1921), Akron, Ohio.*

Santowhite: Reg. U. S. Pat. Off.

Accelerators • For fast, slow, and regulated rates of safe cure.

Antioxidants • For maximum oxidation resistance.

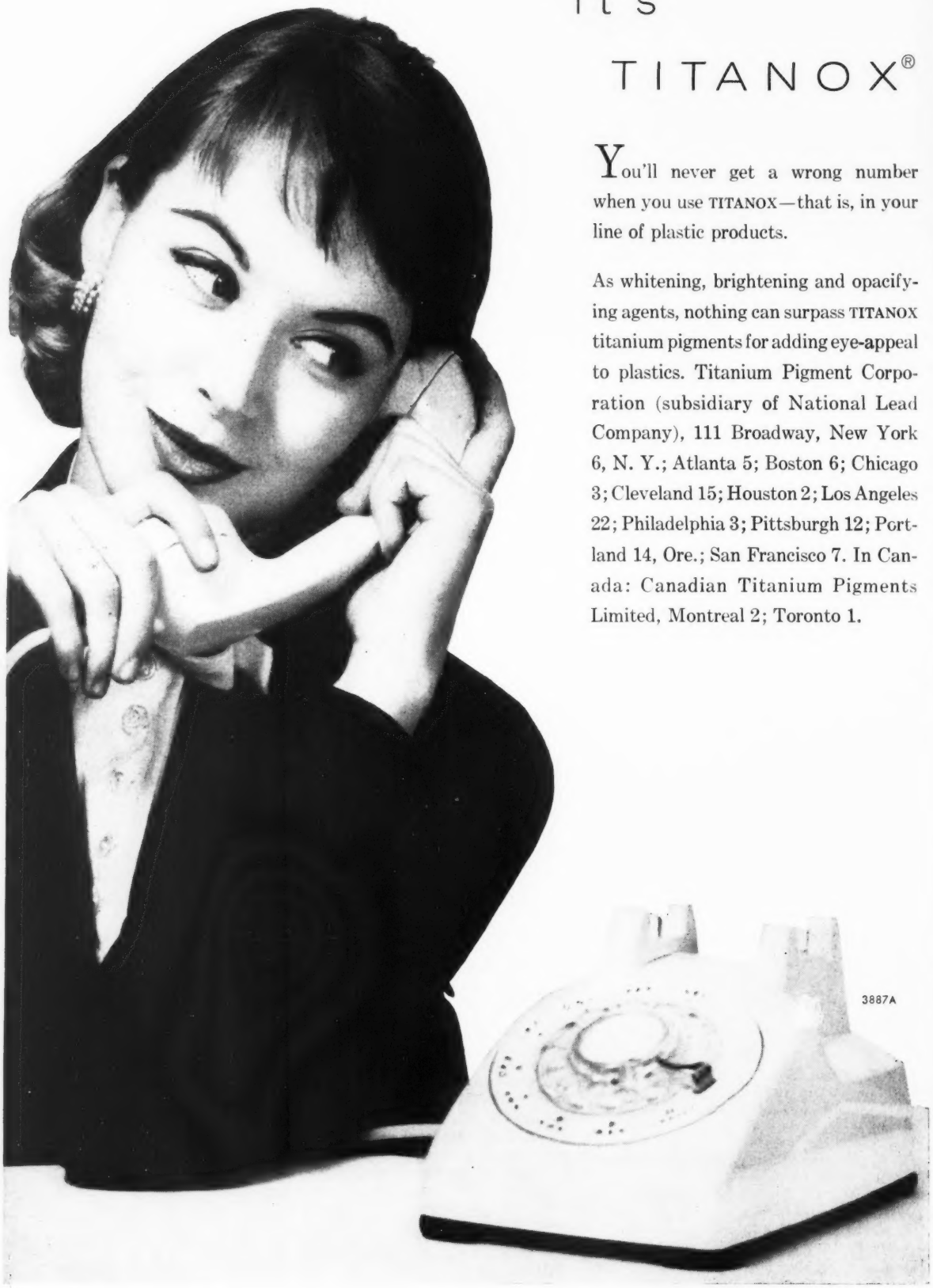
Specialty Compounds • For special processing problems.

MONSANTO

look...

it's

TITANOX®



You'll never get a wrong number when you use TITANOX—that is, in your line of plastic products.

As whitening, brightening and opacifying agents, nothing can surpass TITANOX titanium pigments for adding eye-appeal to plastics. Titanium Pigment Corporation (subsidiary of National Lead Company), 111 Broadway, New York 6, N. Y.; Atlanta 5; Boston 6; Chicago 3; Cleveland 15; Houston 2; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 14, Ore.; San Francisco 7. In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

FOR
COMPLETE PROTECTION
FROM OZONE CRACKING

UNIVERSAL'S
HIGH POTENCY
ANTIOZIDANTS...

UOP 88® and 288
TRADEMARK

● If your product contains rubber, natural or synthetic, you can now give it complete protection from ozone cracking. Universal's rubber antiozidants, the new UOP 288 and the widely-used UOP 88, are now being manufactured in a modern new plant, assuring ample supplies and rigid quality standards.

We will be glad to recommend the correct formulation to insure the best protection for your rubber products.

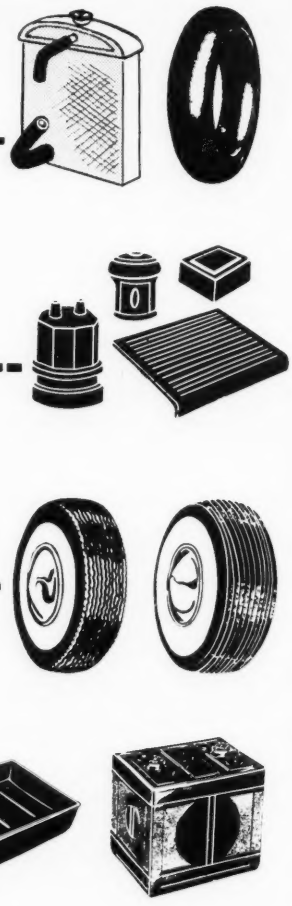
PRODUCTS DEPARTMENT
UOP
UNIVERSAL OIL PRODUCTS COMPANY
30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

Butylite

MOCCASIN

#2750

BOND



THERE'S A PEQUANOC RECLAIM for your rubber formula

These four standards are only a few of the many well-known rubber reclaims available to you at Pequanoc for specific applications.

In their fifty years of specialization, Pequanoc technicians have developed top quality reclaims recognized and accepted by the rubber industry as standard. To keep this product leadership, Pequanoc maintains a modern laboratory for constant supervision of quality and performance.

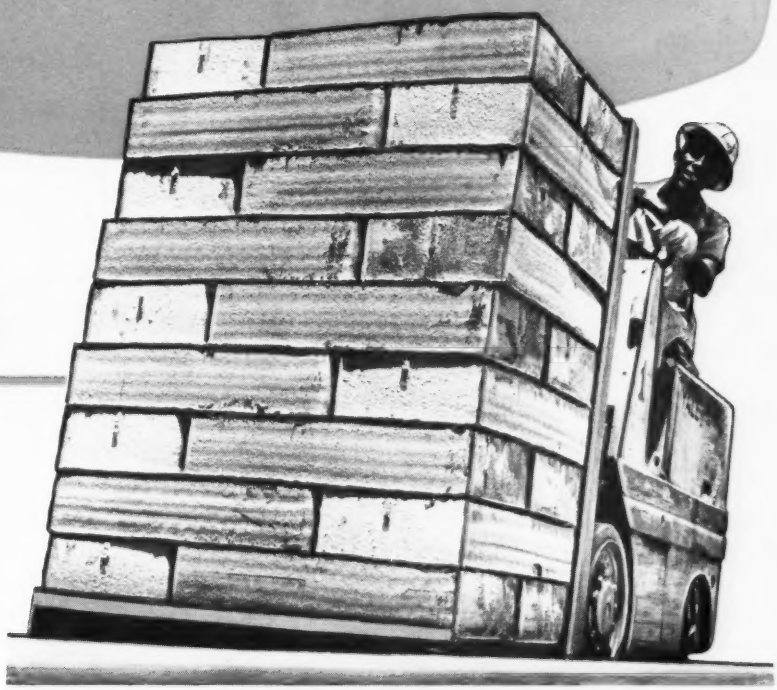
To manufacturers looking for economies in their product, we say — **"There is a Pequanoc reclaim for your rubber formula."** On your particular problem, consult with Pequanoc — you are always assured personal and prompt attention.

Pequanoc Rubber Co.

MANUFACTURERS OF RECLAIMED RUBBER **MAIN SALES OFFICE and FACTORY: BUTLER, N. J.**

BAYTOWN

SYNTHETIC RUBBER



In mid-1955 United Rubber & Chemical Company, a subsidiary of United Carbon Company, purchased the Baytown, Texas, synthetic rubber plant of the RFC's Synthetic Rubber Division.

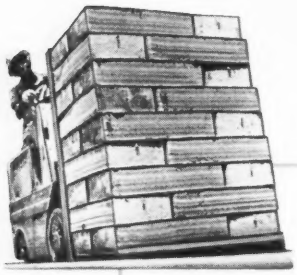
Since that acquisition thousands upon thousands of tons of Baytown synthetic rubber masterbatches have been sold both in the United States and abroad.

The name Baytown has gained prominence in the rubber industry. It is synonymous with dependability and uniformity, careful control and manufacturing excellence.

Commercial manufacture of black masterbatches was initiated at Baytown, and research still is being continued there to supply consumers with the best quality masterbatches that United Rubber can produce.

Baytown brands merit your confidence.

UNITED RUBBER AND CHEMICAL COMPANY



BAYTOWN MASTERBATCHES save you the job of mixing carbon black in rubber: United has done the task nicely, and has dispersed the black thoroughly and uniformly.

BAYTOWN MASTERBATCHES have the stamp of quality: they are stepping stones to achieving excellence in your end products.

BAYTOWN MASTERBATCHES are easy and convenient to handle. They are readily warehoused in a minimum of space. And using them will help keep your premises clean.

For greater progress in the preparation of your compounds, use . . .

BAYTOWN MASTERBATCHES

SALES AGENT

UNITED CARBON COMPANY, INC.

MANUFACTURER

UNITED RUBBER & CHEMICAL COMPANY

SUBSIDIARIES OF

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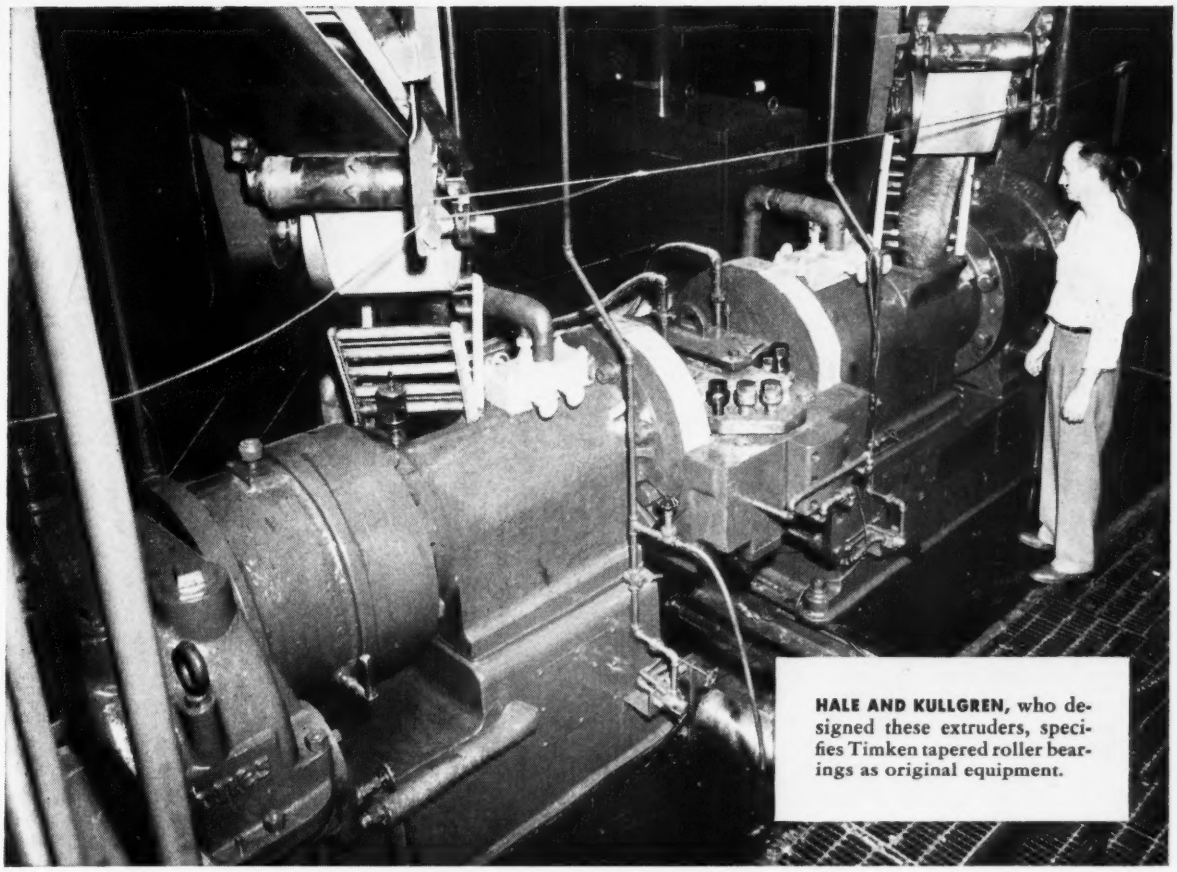


HALE AND KULLGREN, who designed these extruders, specifies Timken tapered roller bearings as original equipment.

Outstanding proof that TIMKEN® bearings can take whopping thrust loads

TWENTY-FOUR hours a day, year after year, these National Erie rubber extruders, redesigned by Hale and Kullgren, Incorporated, and built by Aetna-Standard Engineering Company, are kept in continuous operation.

Timken® tapered roller bearings are mounted on sleeves in the independent thrust units of these machines. As a result of their tapered construction, Timken bearings carry thrust and radial loads in any combination. Because of the tremendous thrust load encountered in this application, a large, steep-angle bearing was specified.

Timken fine alloy steel, made in our own mills, is case-carburized to provide a hard wear-resistant surface over a tough, shock-resistant core. This results in longer bearing life and trouble-free performance under grueling conditions.

In no other bearing can you get the combination of advantages which Timken bearings give you. Specify Timken bearings in the equipment you build or buy. Look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

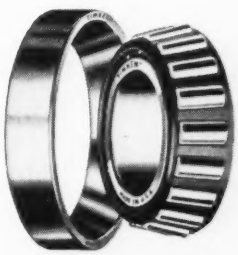
REVOLUTIONARY BUCYRUS PLANT HELPS HOLD DOWN RISING COSTS

At a new plant in Bucyrus, Ohio, the Timken Company has substantially reduced the cost of tapered roller bearings by: 1) producing these bearings under a new system of extreme mechanization; 2) standardizing on 13 bearing sizes with the widest applications throughout industry. Manufacturers can take advantage of these lower costs by redesigning applications to use these Bucyrus sizes. And as more switch to Bucyrus bearings, production costs can drop still further, meaning even lower costs to you.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⇕ AND THRUST →○← LOADS OR ANY COMBINATION →⊙←

Goodrich-Gulf Chemicals, Inc.

good sign for your future . . .

GOODRICH-GULF TAKES OVER LARGEST GOVERNMENT SYNTHETIC PLANT

THIS giant synthetic rubber plant at Institute, West Virginia, the largest of thirteen war-built copolymer plants, has now been acquired by Goodrich-Gulf Chemicals, Inc.

This is a good sign for industries using rubber, as the bulk of Institute's production of Ameripol rubbers will be available to small business. The plant is being modernized, and research and development facilities are being expanded to provide superior technical assistance to purchasers.

Growth and expansion have a way of being contagious. Look for more things to benefit industry from Goodrich-Gulf.

Ameripol RUBBER REG. U. S. PAT. OFF.

Cold Non-Oil Polymers
•
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•
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Philadelphia	Penna. Industrial Chemical Corp.	Jeffrey at Delaware Streets Chester, Penna.	Chester 4-4381
South Atlantic	Fulton Warehouse	544 Means Street, N.W. Atlanta, Ga.	Walnut 9257
Pittsburgh	Penna. Industrial Chemical Corp.	State Street Clairton, Pa.	Belmont 3-8600
Detroit	D. H. Overmyer Warehouse Co.	1197 West 67th Street Cleveland, Ohio	Phone Detroit collect at Woodward 3-5020
	Jefferson Terminal Warehouse	1900 East Jefferson Street Detroit 7, Mich.	Woodward 3-5020
	William B. Tabler Co.	1029 West Main Street Louisville 2, Ky.	Clay 7666
	Cincinnati Transfer Co.	1440 West Eighth Street Cincinnati, Ohio	Cherry 1-0080
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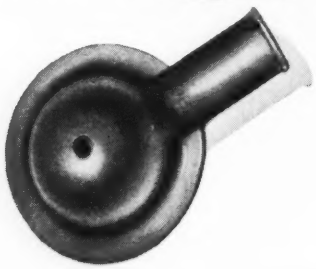

"Tumbling with Pureco liquid CO_2 eliminated die-trimming on several product lines...

and saves 3-4 hours in deflashing time", says P. W. Floeckher, Canfield Rubber Co., Bridgeport, Conn.

"Previously we would first die trim rubber parts and then finish tumble them in a barrel with Pureco "DRY-ICE". Results were good, but required time to complete. Recently we experimented with Pureco liquid CO_2. The results far surpassed our expectations. Parts which used to be die trimmed in 3 to 4 hours can now be fully trimmed in minutes.

"Quite naturally we cannot trim all our items in this manner. Nevertheless, we have found several where die trimming can be eliminated entirely."

Your Pureco man can help you discover how a "frozen" rubber tumbling technique can give you better results with savings in time, material and manpower. He can arrange for an actual demonstration in your plant. Or, he can take some of your "problem" parts to experts at the Pureco laboratories. You'll receive a confidential report on the tumbling technique that will do the best job for you.

Either way, there's no cost or obligation. Call in your Pureco man as soon as possible!

PURECO CO_2

Pure Carbonic Company

NATIONWIDE "DRY-ICE" SERVICE-DISTRIBUTING STATIONS IN PRINCIPAL CITIES

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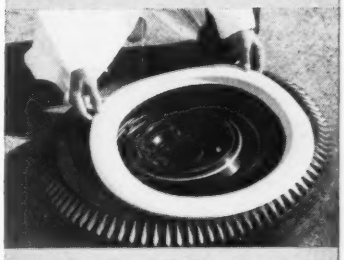
PURE CARBONIC COMPANY is a division of **AIR REDUCTION COMPANY, INCORPORATED** • Principal products of other divisions include: **AIRCO** — industrial gases, welding and cutting equipment and acetylenic chemicals • **OHIO** — medical gases and hospital equipment • **NATIONAL CARBIDE** — pipeline acetylene and calcium carbide • **COLTON** — polyvinyl acetates, alcohols and other synthetic resins.

HOW FLEX-A-WALL SIDEWALLS ARE MOUNTED

1 Remove the valve core and deflate tire completely.



2 Place Flex-A-Wall evenly around surface of rim.

3 Replace valve in stem and inflate the tire slowly.

Flex-A-Wall is a product of Bearfoot Airway Corporation, Wadsworth, Ohio.

NOW! New white or colored snap-on sidewalls made with Hi-Sil!®

Flex-A-Wall is the name of these exciting new snap-on sidewalls in white or 5 different colors that beautify any car . . . and Hi-Sil is the Columbia-Southern pigment that helps make them possible.

In the development of Flex-A-Wall, it was important that a reinforcing pigment be used that would give the butyl rubber an attractive finish, durability, scuff and abrasion resistance, and yet enable it to be produced in white or light colors.

Hi-Sil provided the perfect answer. The Flex-A-Wall sidewalls have all the desired properties and they adhere snugly to the tires under all weather conditions without the use of adhesives.

If you have a rubber compounding problem—whether it be in color or improving certain properties—investigate Hi-Sil.

Hi-Sil, a white reinforcing pigment of extremely fine particle size, is an exclusive product of Columbia-Southern. For further information, table of properties, or experimental working samples, write today to Hi-Sil Department at our Pittsburgh address.

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by

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Cary "Antisun",

formulated of the finest quality ingredients and proven so satisfactory in tire compounding, mechanical goods, insulated wire and cable compounds, is still the same basic formula developed by our President years ago.

- Recommended usage: 2-4% of the weight of the rubber hydrocarbon, depending on the degree of protection desired.
- Unlimited Availability.
- Low Cost.
- Available in convenient chipped or slabbed forms.

Accept no substitute for this time-tested, highest quality product — CARY "ANTISUN".

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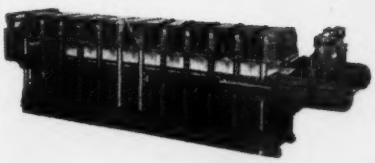
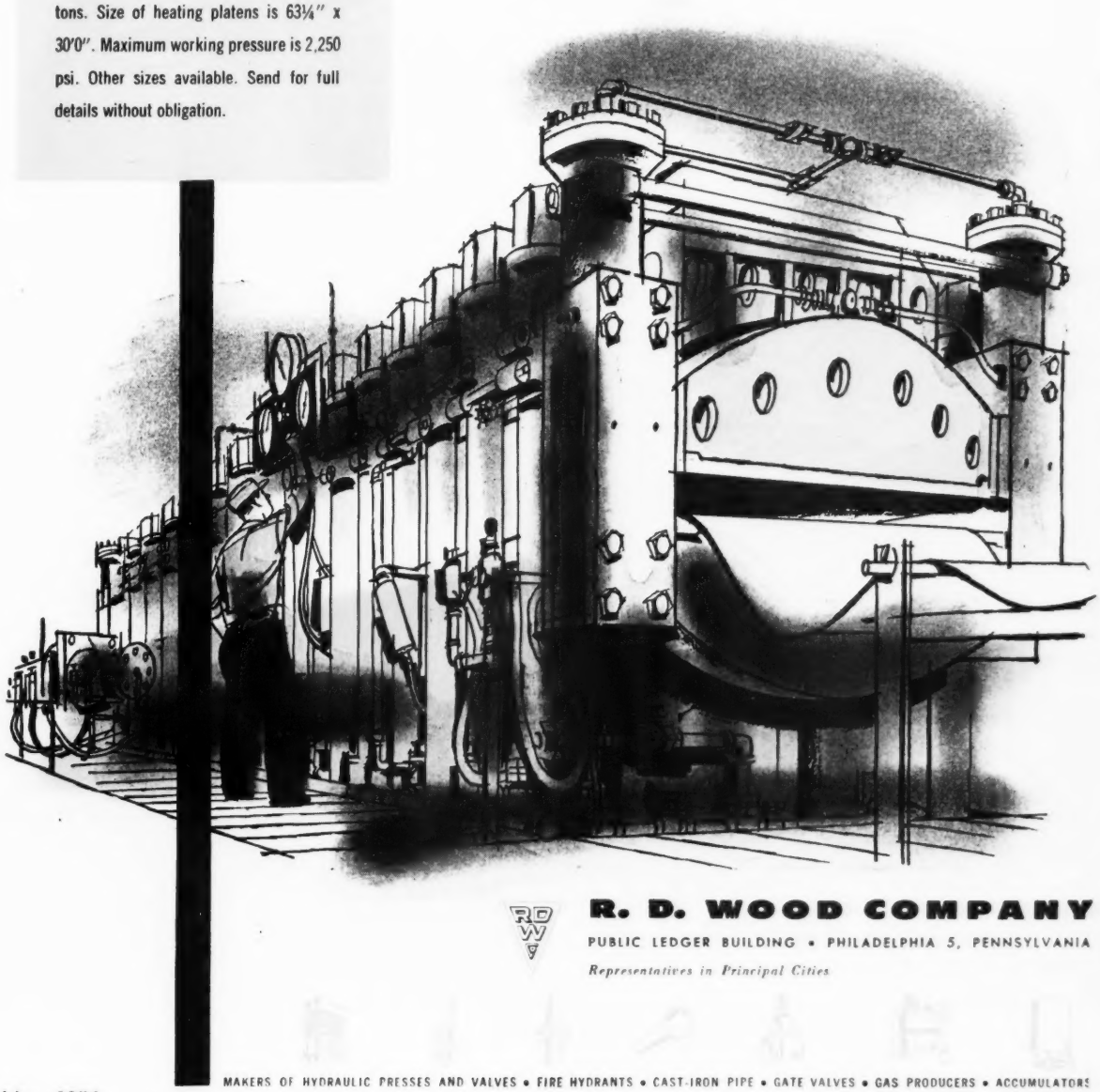
Canadian Representative: Lewis Specialties, Ltd., 1179 Decarie Blvd., Montreal 9, Que.

The standard by which other presses are judged



Single Opening Belt Press for vulcanizing rubber belting. Press is equipped with hydraulic stretcher and clamping units mounted at the ends of the moving platen to maintain tension on belt while it is being processed. Press capacity is 3,180 tons. Size of heating platens is 63¼" x 30'0". Maximum working pressure is 2,250 psi. Other sizes available. Send for full details without obligation.

The proof of any press is its performance: excellence invariably shows up in service. How to be sure of quality when you choose a press? Simply look for the name 'R. D. Wood' on the nameplate. During more than 150 years, this name has never appeared on a press of inferior quality. In every R. D. Wood press, meticulous design, select materials, scrupulous craftsmanship combine to give you over-all efficiency, operating ease, production economy and long service. Write for engineering data on R. D. Wood presses for the rubber industry.



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Plasticize GR-S with PARA FLUX®

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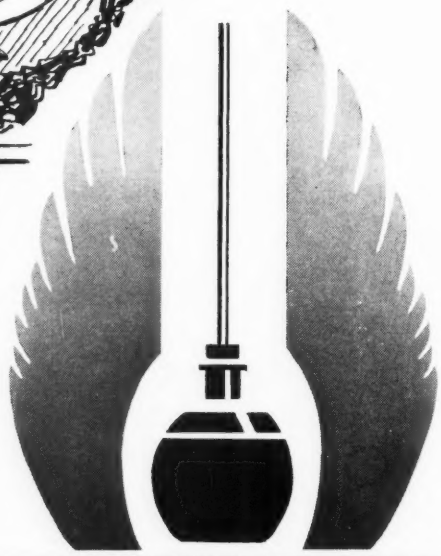

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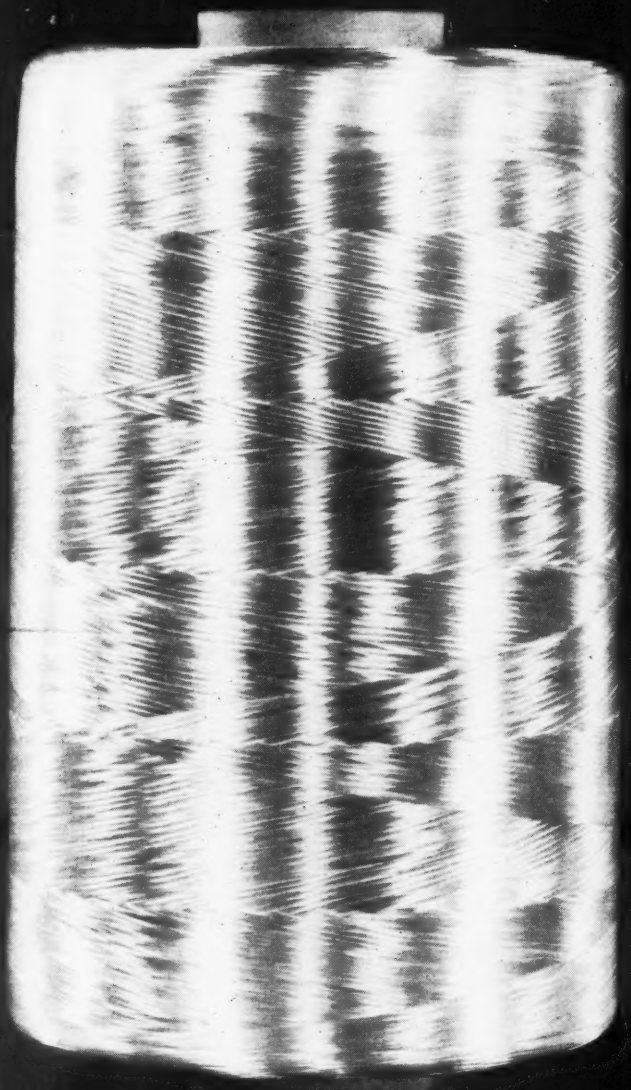
—a new trademark character we've adopted to represent our PHILPRENE® Polymers and Masterbatches.

He's a cheerful fellow with a sunny disposition—always ready to help solve problems you may encounter with rubber products.

Call on MR. PHILPRENE and his staff of experienced scientists and technicians at our Technical Service Laboratory. Write, wire or phone!

PHILLIPS CHEMICAL COMPANY, Rubber Chemicals Division, 318 Water Street, Akron 8, Ohio

NOW, brought to you



*caprolan**

NYLON HEAVY YARNS

Allied Chemical's new Caprolan heavy yarns are of particular interest to makers of:

Heavy Duck • Industrial Slings • Fire Hose • Cords & Braids
Upholstery Fabrics • Webbings • Conveyor Belt Fabrics
Rope & Twine • Tapes & Belts • Carpets & Rugs

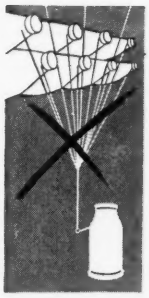
* TRADE MARK

exclusively by Allied Chemical...Caprolan*!

Nylon Heavy Yarns

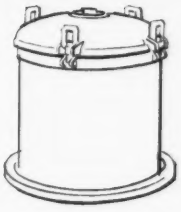
A Completely New Class of Durable Textile Yarns Available in 2,100, 2,500, 5,000 and 15,000 Denier

Mills report these advantages:



1. Cuts Plying Costs! Supplied in the total deniers you need, Caprolan nylon heavy yarns are engineered to your specifications without plies. No need to inventory costly finer deniers. Heavy yarns with nominal twist are supplied on knotless 10-pound parallel nonreturnable tubes.

2. Cuts Heat-Setting Cycles! Another money-saving advantage of these heavy yarns is that heat-setting cycles can be materially shortened because of Caprolan's workability with heat.



3. Minimizes Dyeing Problems! Heavy nylon constructions are much easier to dye when Caprolan heavy yarns are used. Allied's new fiber has a remarkable affinity for all classes of dyestuffs.

Other Heavy Yarns Can Be Engineered to Your Specifications In a Range from 2,000 to 50,000 Denier!

Now, from Allied Chemical—an important new tool for the textile industry—nylon heavy yarns engineered to your specifications! This completely new class of durable textile yarns eliminates need to ply multiple ends of finer deniers to achieve a higher total effect.

Caprolan heavy yarns are versatile, too. Whether you make duck, webbings, carpet, upholstery or any other type of heavy nylon fabric these heavy yarns will find a place in your mill. They are especially effective where toughness and high impact strength are important considerations.

These nylon heavy yarns are made exclusively by Allied Chemical. In addition to all of the known qualities of nylon, Caprolan heavy yarns offer such plus values as affinity for all classes of dyestuffs, *deep* dyeing and uniform level shades.

These new heavy yarns already are in commercial use in important mills and evaluation programs are under way in many others. If you would like more information, technical assistance, or would like to evaluate Caprolan heavy yarns in your own mill, write:

Fiber Sales and Service

NATIONAL ANILINE DIVISION

Allied Chemical & Dye Corporation

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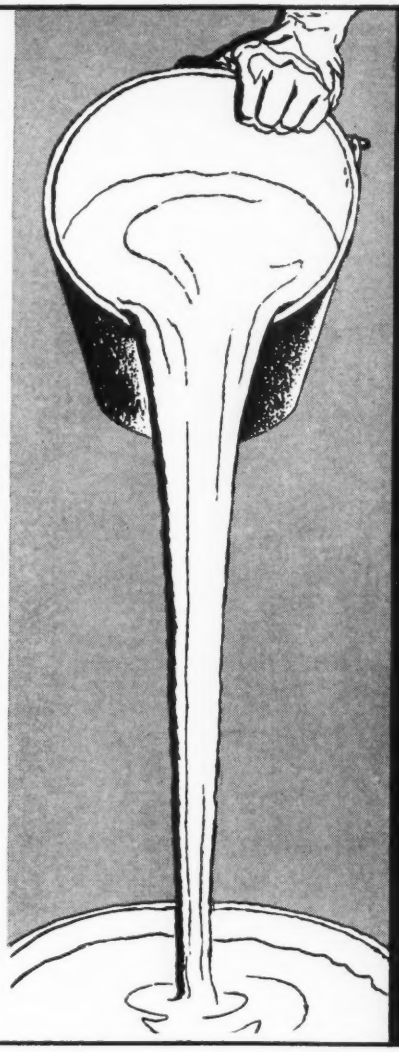
It's inert to hydrolysis and bacterial action...



the thickener that pours easily!

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A SYNTHETIC POLYMER

You're likely to find an ideal combination of advantages when you thicken latex with Modicol VD. For this synthetic polymer gives uniform high viscosity . . . smooth and gel-free . . . even at very low concentrations.

Modicol VD pours easily, saves you time, guesswork and material waste.

Modicol VD not only eliminates creaming and separation but also improves mechanical stability of the latex emulsions. These are all typical advantages. Why not find out how Modicol VD can help improve your own processing. Simply send today for bulletin MVD 33 to Nopco Chemical Company, Harrison, N. J.

Advantages of MODICOL VD

Easy to handle
High uniform viscosity at low concentrations
Smooth gel-free type of viscosity
Stable in alkaline fluids
Unaffected by bacteria or fungi

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For better Sales-Making Properties in Many Rubber, Neoprene and Vinyl Products...

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SILENE-EF in natural rubber and GR-S products assures improved elongation, higher tensile strength, better hardness and tear resistance to give so many of the appealing properties in a wide range of manufactured rubber goods.

IN COLORED PRODUCTS

SILENE-EF is the versatile white reinforcing pigment that provides so many desirable properties in a wide range of products . . . Today's demand for color in so many items made of natural, GR-S, Nitrile rubbers, Neoprene or Vinyls calls for just such an agent to give strength in loading, high tear resistance and superior tensile without sacrifice of color quality.

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SILENE-EF serves as an acid acceptor and mild heat stabilizer in vinyl resins. In films and sheet stock it can be used without reduction of physical properties or translucency of film. It disperses easily in moderately loaded vinyl stocks.

Write for bulletin giving complete data on use of SILENE-EF
SILENE-EF is manufactured by Columbia-Southern Chemical Corporation

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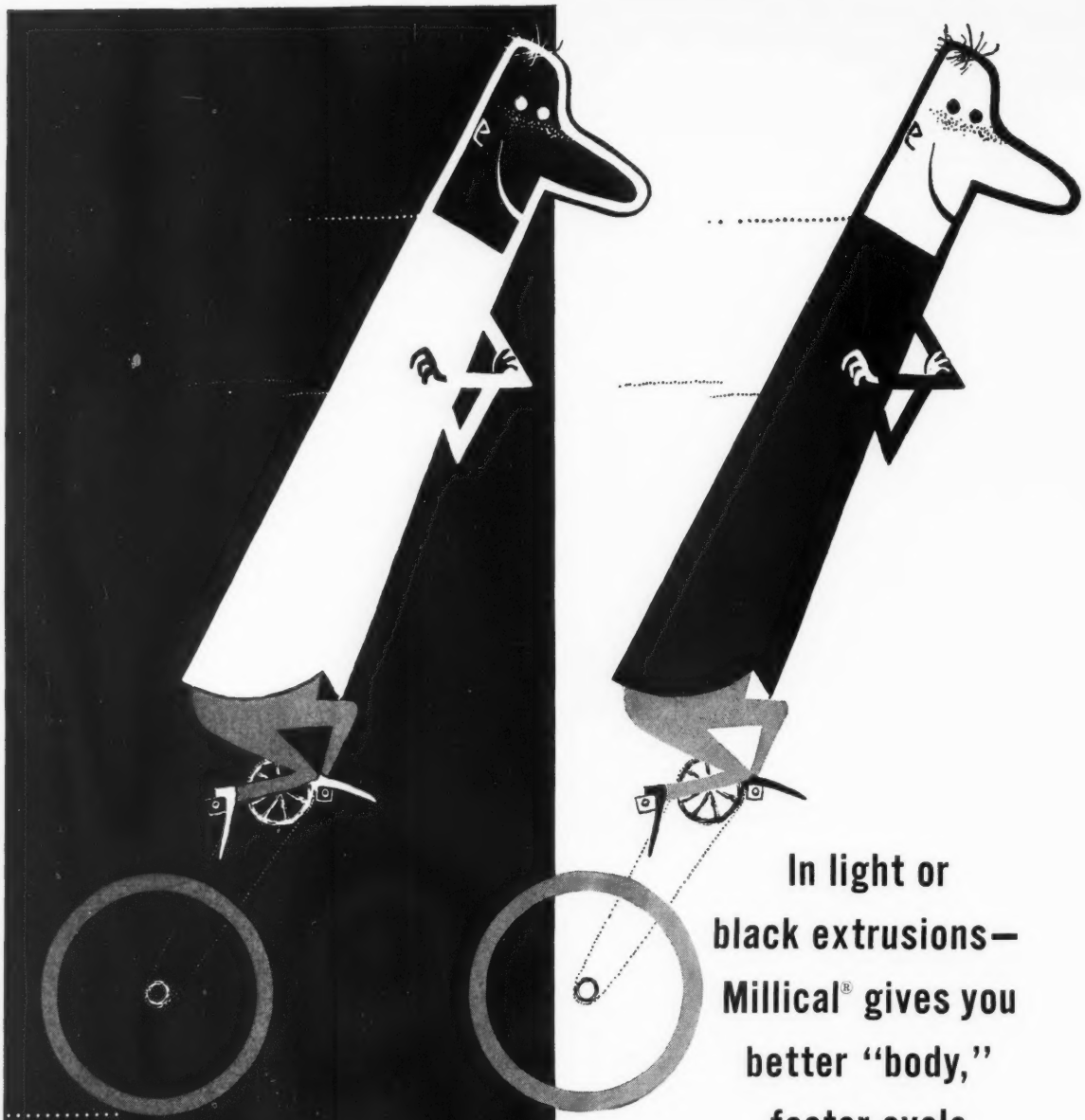

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Diamond Chemicals

In light or black extrusions— Millical® gives you better "body," faster cycle

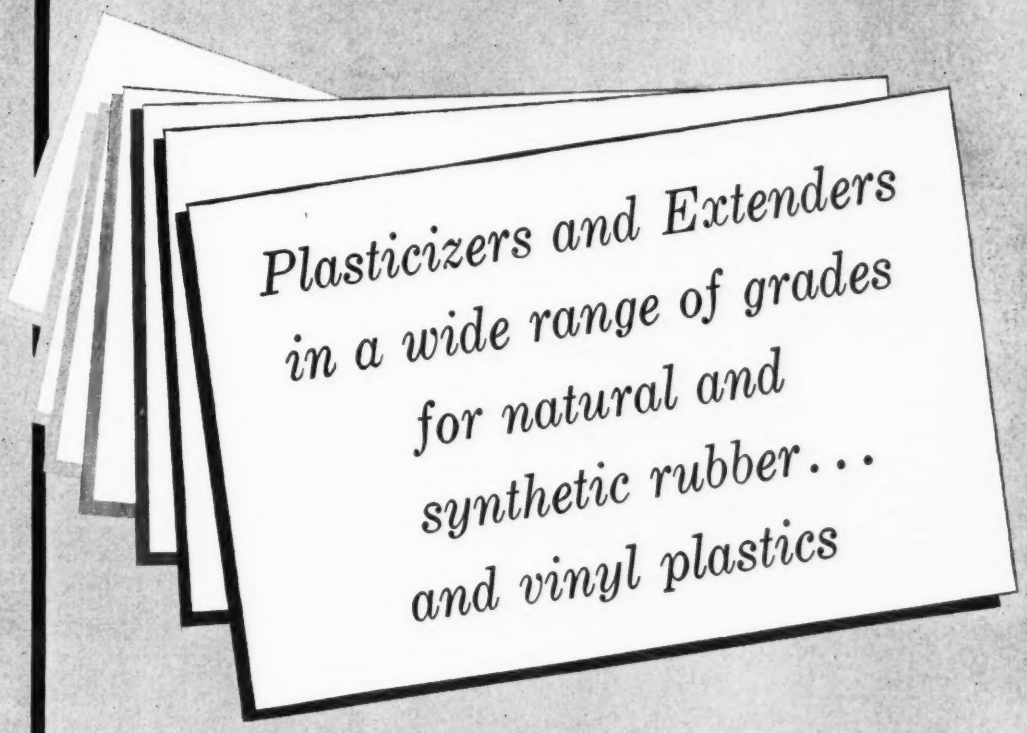
Looking for an easy mixing pigment that will stop extruded stock from sagging and collapsing in open steam cures? DIAMOND's Millical provides a nonporous excellent "body," due to its fine particle size (1 micron), particle shape and uniformity.

DIAMOND recommends Millical as a primary filler in rubber floor tile, synthetic rubber shoe soles, molded mechanical goods, tubing—anything, light or dark, needing higher shore hardness than ground limestone can provide.

Millical produces smooth extrusions. It calenders very well and improves tensile and tear properties. It will speed up your curing cycle and boost production.

Call your nearby DIAMOND representative today for information and technical help on Millical and other high-grade calcium carbonates. Or write DIAMOND ALKALI COMPANY, 300 Union Commerce Building, Cleveland 14, Ohio.

SHELL DUTREX



SHELL OIL COMPANY

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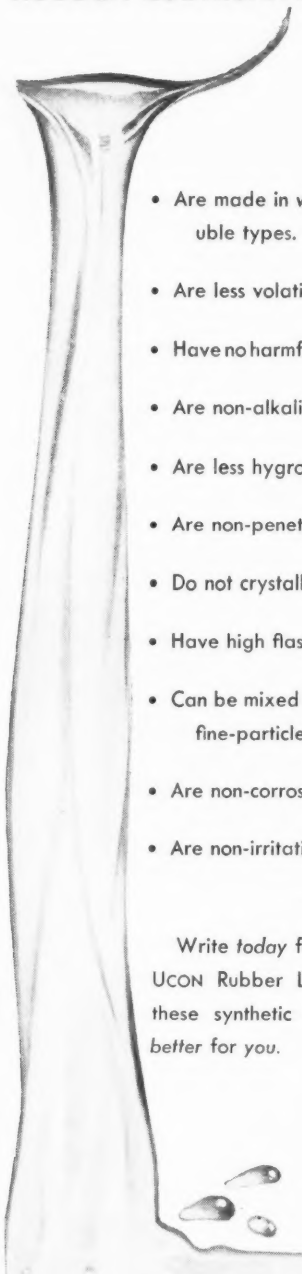
for:

tire-bags
foam rubber
mechanical goods
latex products
cutting tools



- Are made in *water-soluble* and water-insoluble types.
- Are less volatile than glycerine.
- Have no harmful swelling or softening effects.
- Are non-alkaline.
- Are less hygroscopic than glycerine.
- Are non-penetrating.
- Do not crystallize or cause bloom.
- Have high flash points.
- Can be mixed with solvents, wetting agents, fine-particle solids, or silicone emulsions.
- Are non-corrosive to the common metals.
- Are non-irritating to the skin.

Write *today* for complete information on UCON Rubber Lubricants. You'll find that these synthetic lubricants can do a job *better* for *you*.

CARBIDE AND CARBON CHEMICALS

CARBIDE AND CARBON CHEMICALS COMPANY

A Division of Union Carbide and Carbon Corporation

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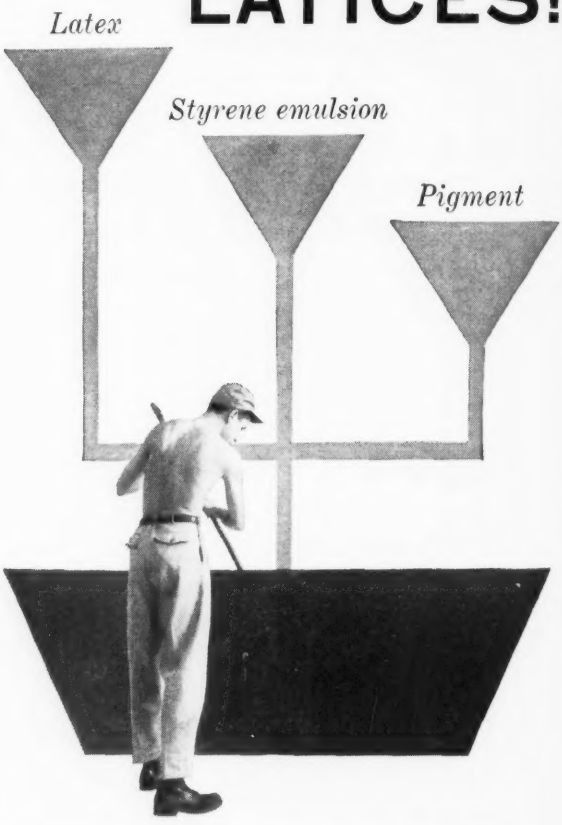
"Ucon" is a registered trade-mark of Union Carbide and Carbon Corporation.

EASIER WAY TO MODIFY

RUBBER LATICES!



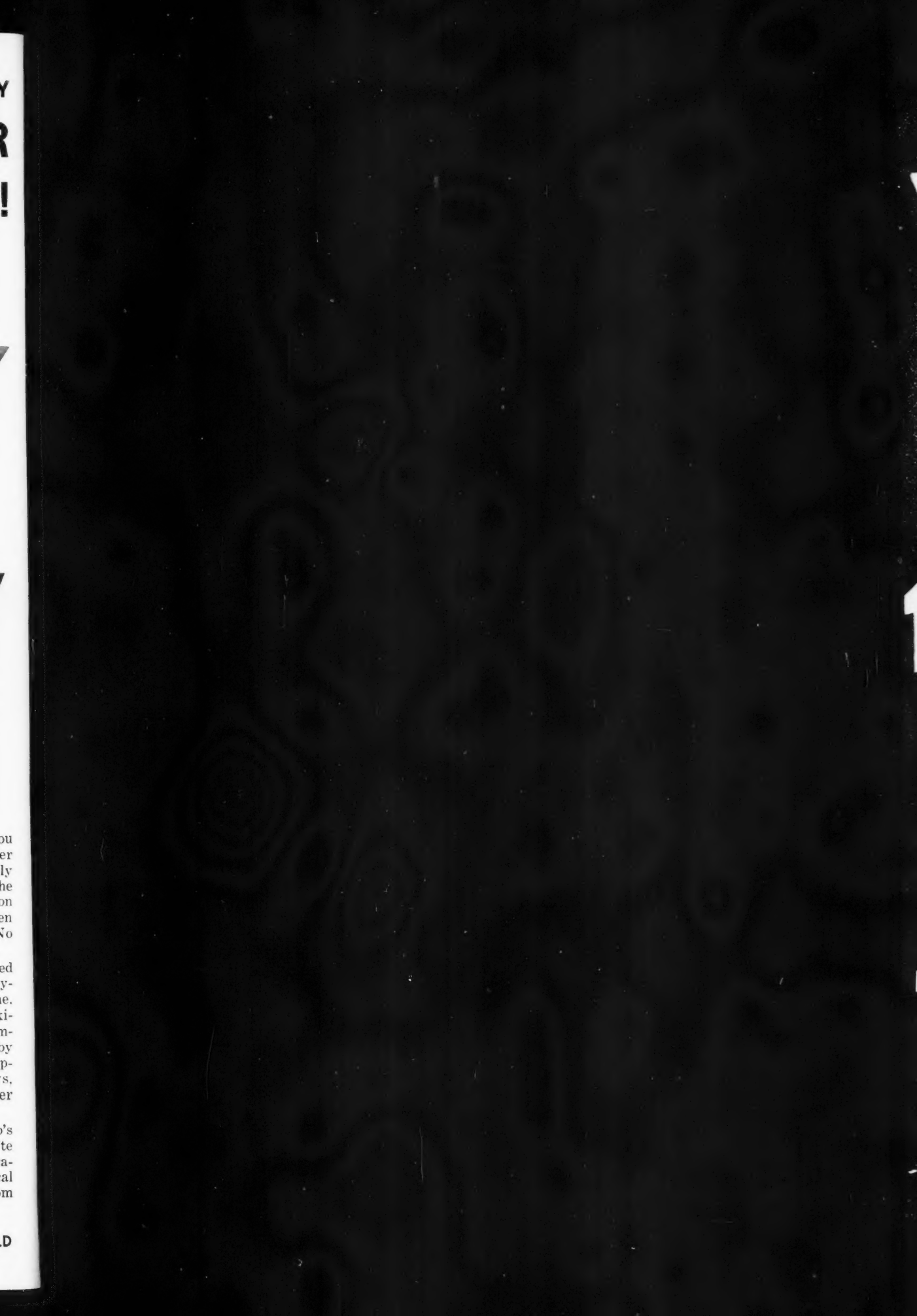
No extra mixing step when you use Monsanto's styrene emulsions

Compounding is simplified when you modify synthetic or natural rubber latices with Monsanto's specially formulated styrene emulsions. The fine particle size allows combination of the emulsion with the latex when pigments and fillers are added. No extra mixing step is required.

Pre-selected ratios can be controlled exactly—from high-rubber low-styrene to low-rubber high-styrene. Recommended for modifying flexibility characteristics of latex compounds used in manufacturing baby pants, girdles, surgical gloves, upholstery fabrics, rug underlays, adhesives, raincoats, foam rubber and many other products.

Prices and supplies of Monsanto's styrene emulsions are stable. Write today for data sheets and laboratory samples. Monsanto Chemical Company, Plastics Division, Room 934, Springfield 2, Mass.

MONSANTO



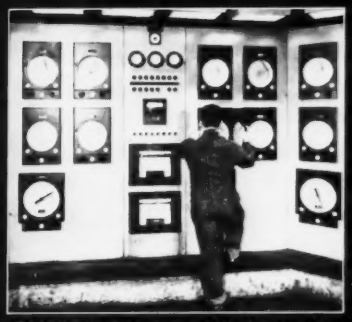
what it takes to make WITCO-CONTINENTAL CARBON BLACKS

It takes complex reactors, automatic controls and efficient collecting facilities . . . and (for channel blacks) thousands of flame tips impinged against a moving channel.

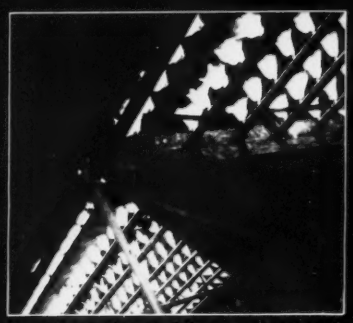
In five modern plants, Witco-Continental manufactures a comprehensive line of carbon blacks for every rubber compounding need.

Witco-Continental has what it takes *(facilities and experience)* to make carbon blacks of highest quality – and to give you expert technical service on your formulations.

For a listing of Witco-Continental Carbon Blacks



This instrument panel helps control properties of Witco-Continental furnace blacks.



Inside a channel house at one of Witco-Continental's channel black plants.

Witco-Continental CARBON BLACKS

Recognized for the past 35 years as dependable Carbon Blacks for rubber products of superior quality.

FURNACE BLACKS

Continex® SRF — Natural Gas Type, Semi-Reinforcing

Continex SRF-NS — Natural Gas Type, Non-Staining

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Continex FEF — Oil Type, Fast Extruding

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CHANNEL BLACKS

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Continental A — Medium Processing (MPC) — Witco No. 1

Continental F — Hard Processing (HPC) — Witco No. 6

Continental R-40 — Conducting (CC)

Witco-Continental's technical service staff at our new laboratory in Akron will be glad to assist you with your rubber formulations.

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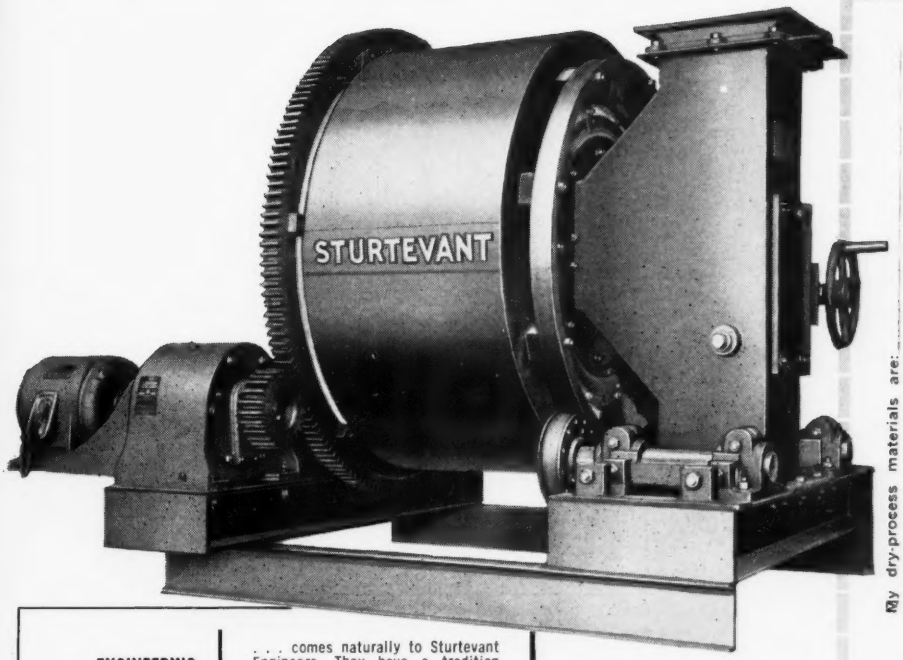
COSTS OF BETTER BLENDS CUT TWO TESTED WAYS



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. . . comes naturally to Sturtevant Engineers. They have a tradition of solving dry-processing problems since 1873. Sturtevant custom-built equipment and plants are well-known for their low-maintenance-cost operation. If your problems include any of the processes listed on the coupon, it will pay you to investigate.

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Batches from 500 to 40,000 pounds come out of Sturtevant Dry-Batch Blenders exactly as you want them. They are completely blended regardless of the varying weights, densities or fineness of the different ingredients. And no dust is lost in the process.

Four different vertical and lateral mixing actions inside the sealed rotating drum achieve thorough blending in minimum time. Single lever control of a single gate speeds up loading and discharging.

"Open-Door" accessibility makes cleaning and maintenance a matter of minutes. This original Sturtevant advantage plus 75-year-tested rugged construction assures more output per machine-year. Check the coupon for more information.

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Dry Processing Equipment

The "OPEN-DOOR" to *lower* operating costs over *more* years

CRUSHERS • GRINDERS • MICRON-GRINDERS • SEPARATORS
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Please send me your bulletin on Dry Blenders ☐
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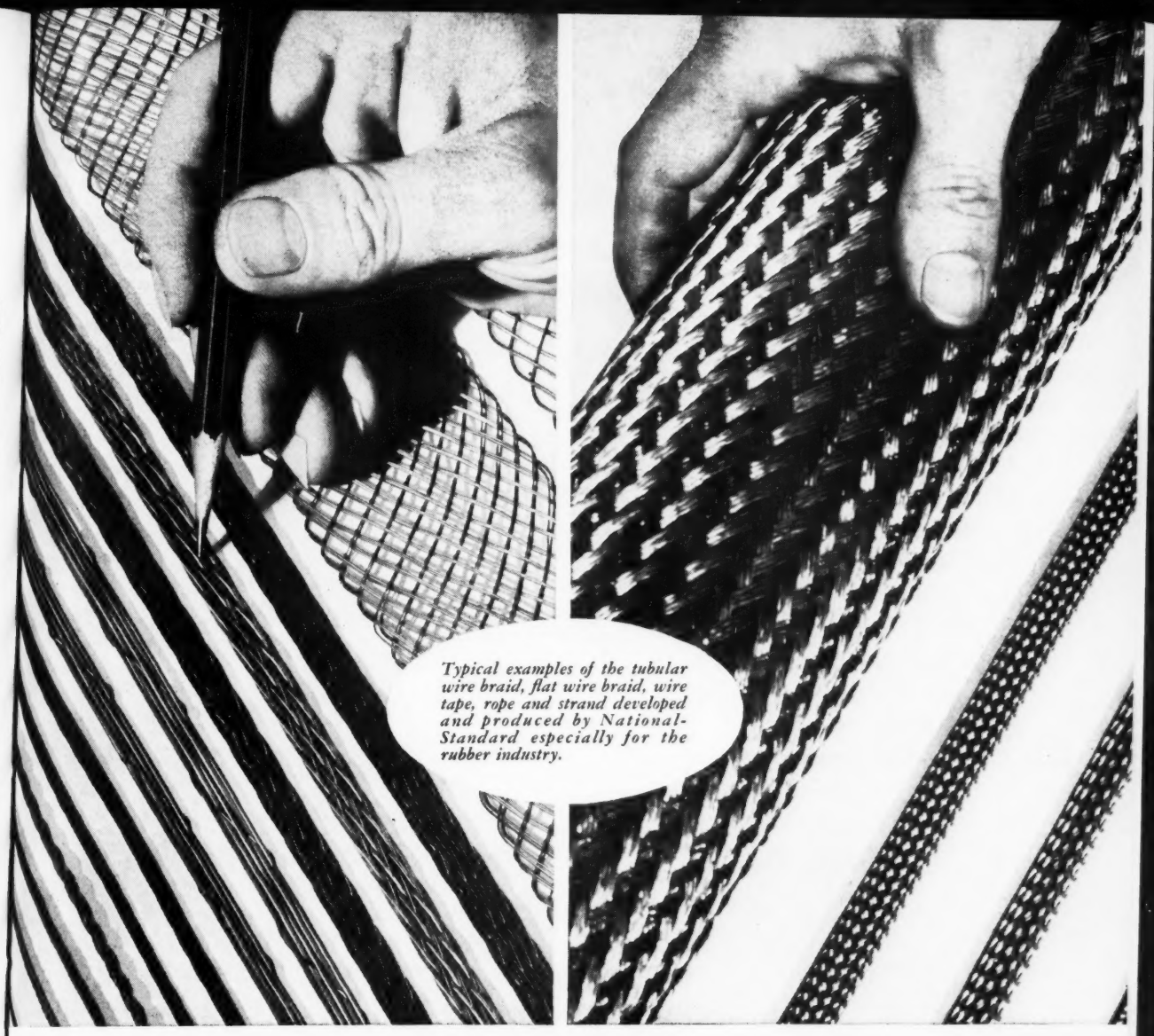

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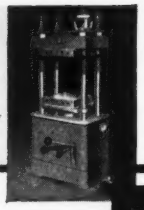

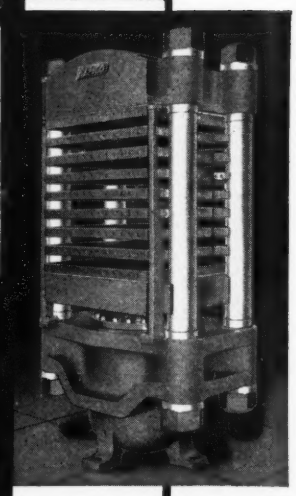

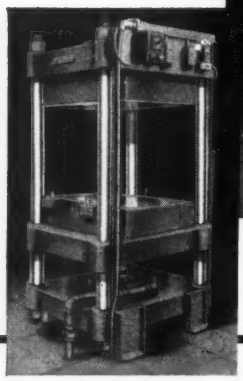

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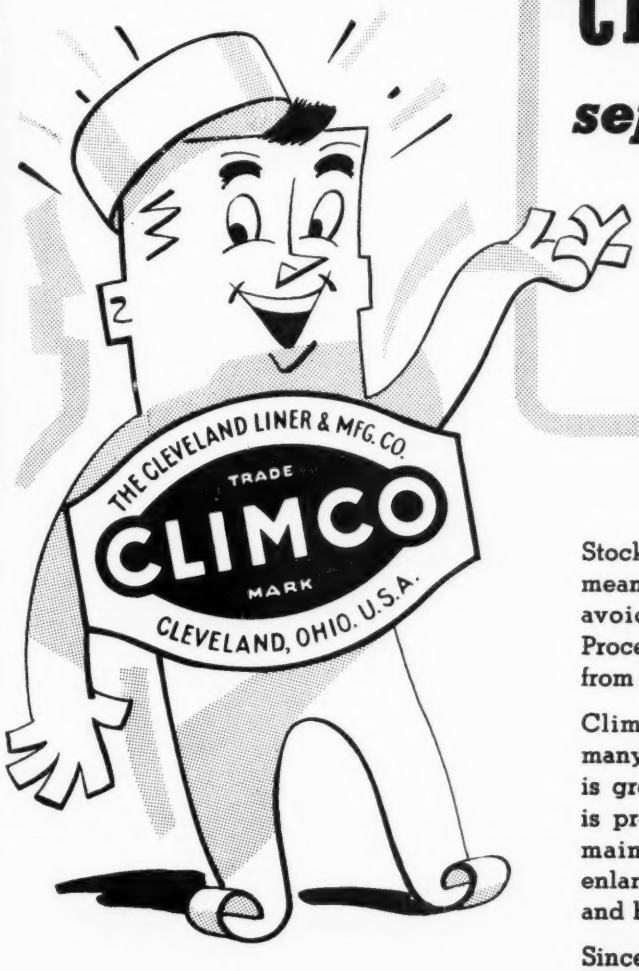

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Stock adhesions at any point in production mean time lost and extra expense. You can avoid such headaches by using Climco Processed liners that can be readily peeled from the stock without sticking.

Climco Processing of your liners assures many other profitable advantages: Liner life is greatly increased, tackiness of the stock is preserved, and gauges are more easily maintained. Latitude in compounding is enlarged, lint and ravelings are eliminated and horizontal storage is facilitated.

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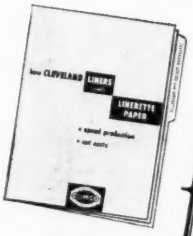

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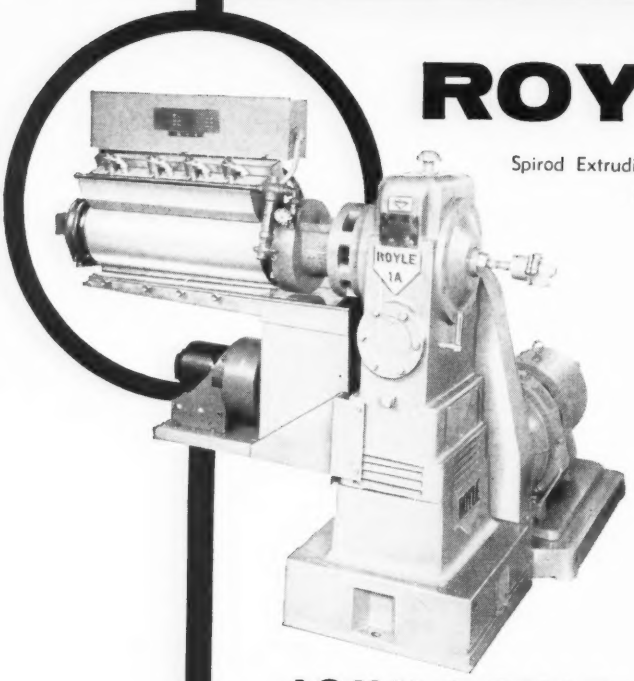

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Available in sizes 1⅛" through 12" cylinder bore.

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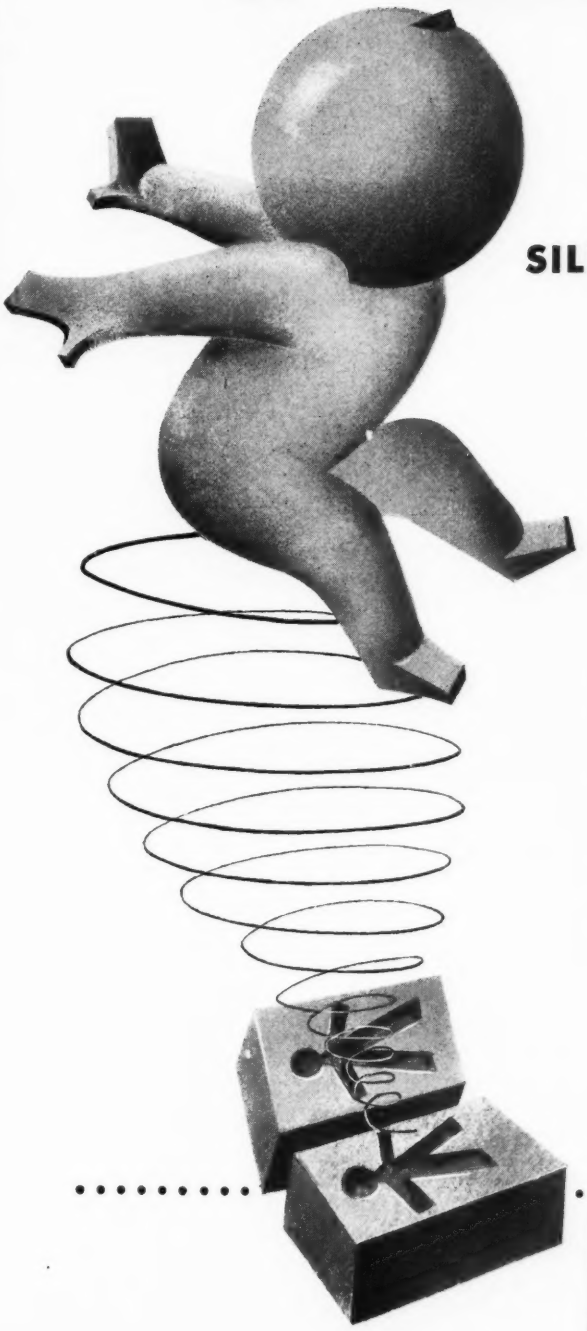
PARTS POP FROM MOLDS



when you use G.E.'s new, improved SILICONE MOLD LUBRICANT, SM-62

General Electric's new silicone mold lubricant, SM-62, offers molders of tires, mechanical rubber goods and plastics quick, easy release—even on the toughest jobs. Parts "come clean"—with better surface finish, sharp detail, close tolerances.

Here are some of the special benefits which SM-62 offers you:

1. **Better surface finish**
2. **Better mold coverage**
3. **Improved stability under mechanical agitation**
4. **Improved stability at high temperatures**

Economical, SM-62 saves you time and money. Non-carbonizing, it reduces mold cleaning costs and down time—minimizes rejects! Only small quantities are required.

NEW APPLICATION FACTS

General Electric has prepared complete, new packages of application data on *silicone mold lubricants* and *antifoam* agents for the rubber and plastics industries. For a free copy of this latest information, just fill in and mail the coupon below.

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Please send me a free copy of your application data on the following:

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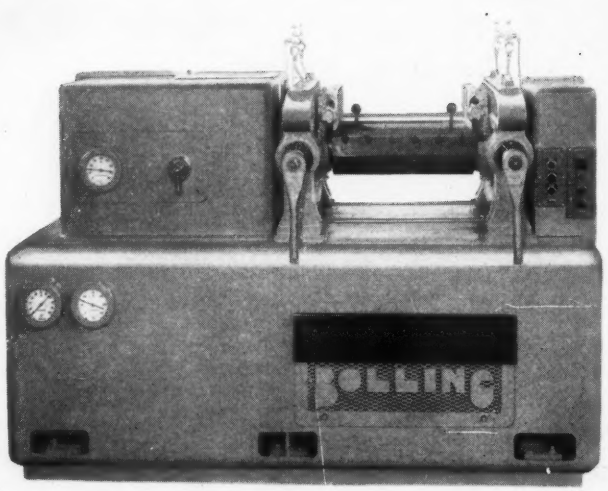
Write on your letterhead for Bulletin W-5



Ten Bolling laboratory mills in sizes from 6" x 16" to 16" x 36" were installed during 1955 in the world's largest and most modern rubber laboratory. One of these mills, an 8" x 20" deluxe model, is shown above.

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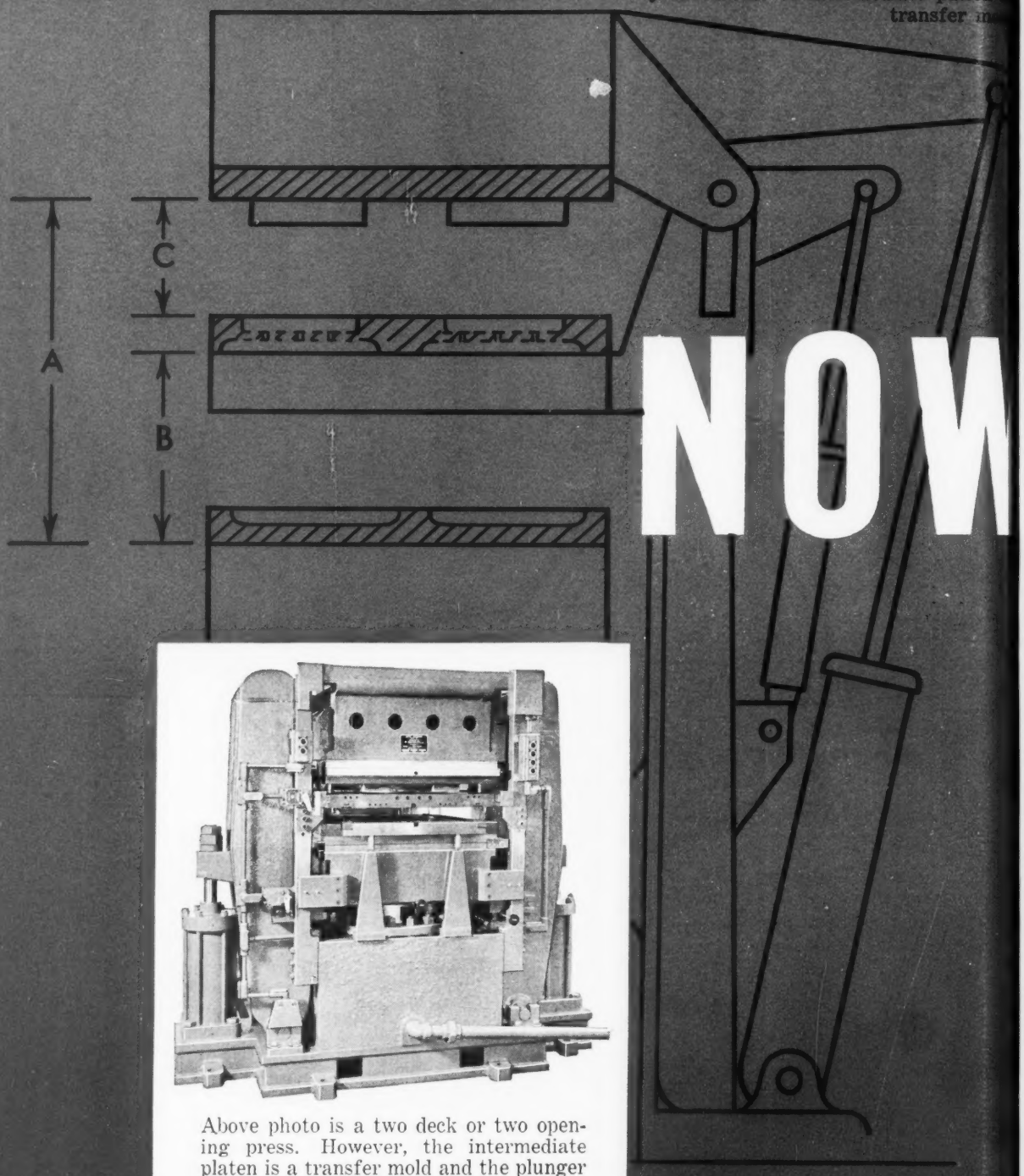
"A" can be adjusted to any req
opening by setting limit of ram trav

"B" and "C" openings can be adju
by movement of intermediate plate
transfer

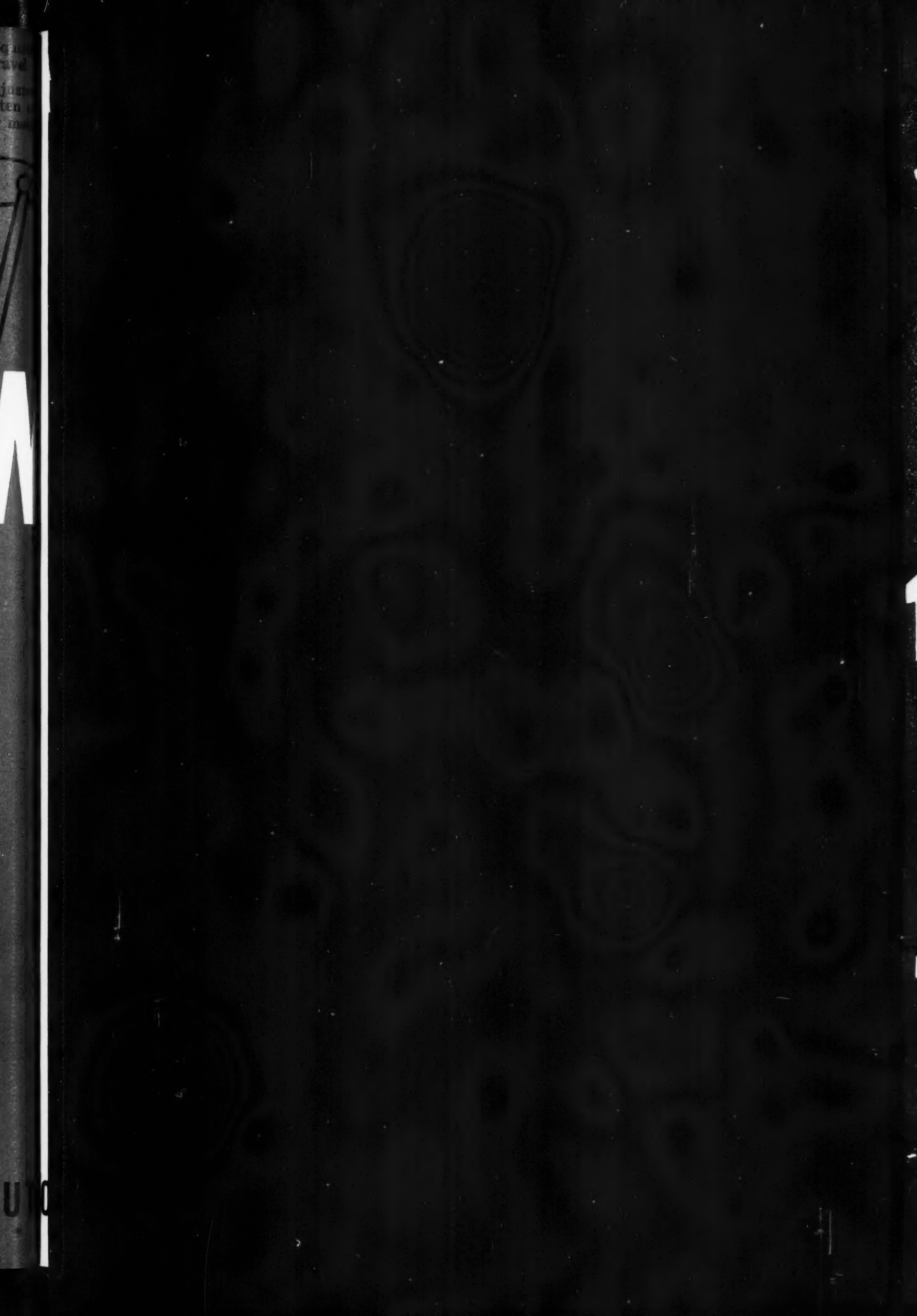


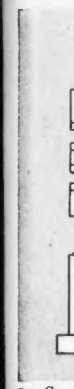
NOW

Above photo is a two deck or two opening press. However, the intermediate platen is a transfer mold and the plunger plate replaces the usual mold fastened to tilting head.

The tilting head design is not new. There are many tilting heads in operation with service records of 15-20 years. However, the two opening design is new.

ONLY THE MATERIAL MOVES IN AND OU





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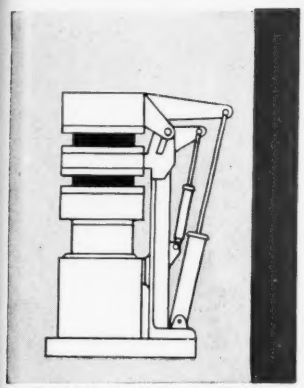
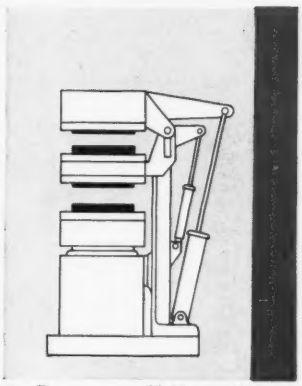
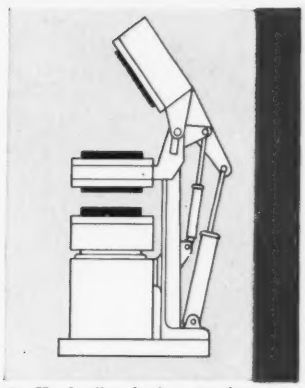


1. Completion of cure. Press is ready to open.

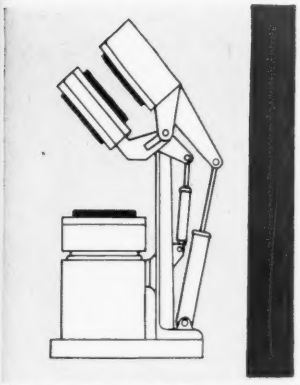


2. Press opens. Molds remain parallel during entire stroke of ram. This is necessary for deep cavity molds.

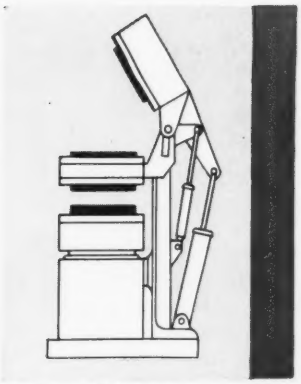


3. Head tilts back, exposing two halves of mold in top deck—cured articles are removed.

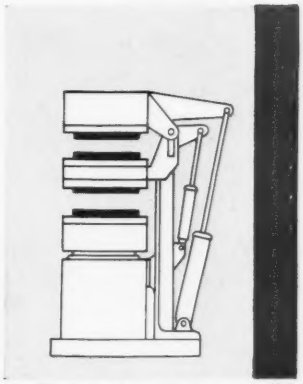
A TWO-OPENING TILTING HEAD PRESS



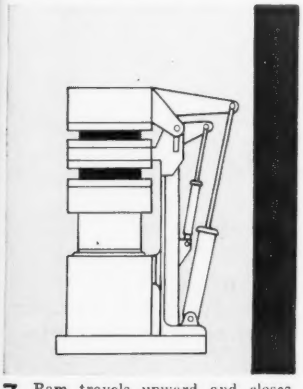
4. Intermediate platen tilts back, exposing two halves of mold in lower deck. Cured articles are removed. Fresh unvulcanized stock is placed in mold cavities.



5. Intermediate platen lowers into parallel position — unvulcanized stock is inserted in mold cavities.



6. Head is lowered into parallel position.



7. Ram travels upward and closes press. DIRECT AND FULL PRESSURE OF HYDRAULIC SYSTEM IS AVAILABLE THROUGHOUT ENTIRE STROKE OF RAM.

- Only the material moves in and out of the press. Molds remain in press, therefore mold halves **stay in register.**
- Cures two sets of molds at the same time.
- Timer, at prescribed intervals, automatically raises and lowers the ram, tilt head and intermediate platen.
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- Two Opening Press can be used as a single opening press for extremely deep molds.

F THE TILTING HEAD

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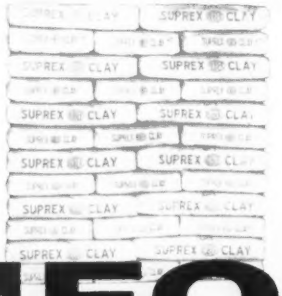
CLAYS....IT'S



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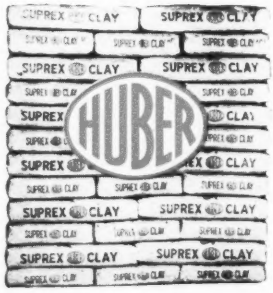

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RUBBER WORLD

MAY, 1956

VOLUME 134, NUMBER 2

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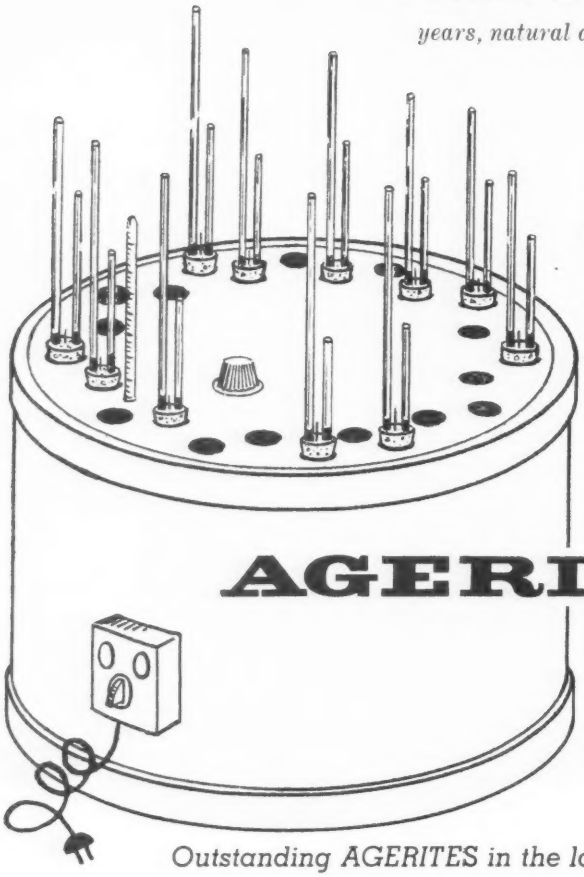

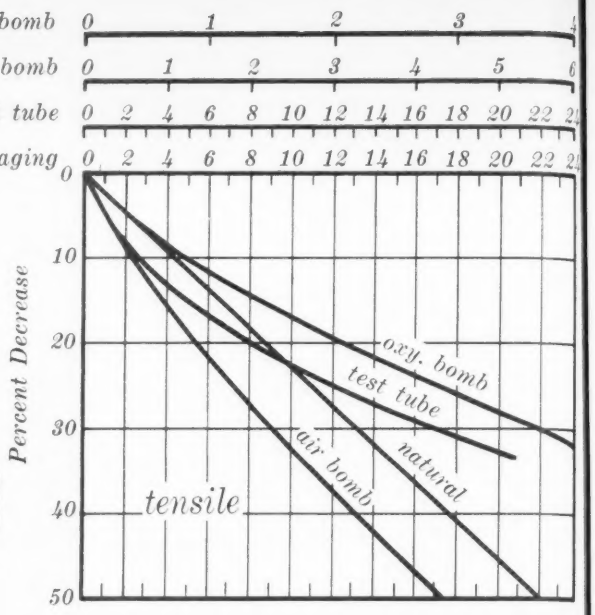

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RUBBER WORLD

MAY, 1956

F. W. Blanchard

"Rubber Railroads"[1]

By F. W. BLANCHARD

Hewitt-Robins, Inc., Buffalo, N. Y.

In the 1890's, Thomas Robins made two basic contributions to increasing the use of belt conveyors. He protected the carcass of the belt with a rubber cover and invented a practical idler which would bend the edges of the belt upward, eliminating the close fitting skirtboard used to hold the material on a flat belt.

From these contributions sprang the greater usage of belt conveyor systems in mine and quarry and elsewhere until in the 1940's "Rubber Railroads" seven to ten miles long were employed in connection with the construction of some of our great dams. Also, the proposed Riverlake project in Ohio would be 103 miles long.

Study of engineering principles of belt design and operation has resulted in improved performance at lower cost. Continued technological advances, expanded research and development, and improved testing and analyzing facilities are expected to open the door still wider to the variety of applications and to greater serviceability of belts and conveyor systems. One of the newest applications is the passenger conveyor at airports and stations.

FOR a hundred years the "iron horse" has been, and still is, the primary mover of bulk materials over long hauls. In recent years the motor truck has rivaled the railroad in many areas of haulage and is today moving 19.2% of the country's freight. The belt conveyor was used as far back as 150 years for moving certain bulk materials—the earliest installations handling grain—but only in the last three decades has the "Rubber Railroad" secured its place as an economically feasible method for the transporting of bulk materials over long distances.

Selection of a system of haulage generally resolves itself to a question of economics. Underground, the belt is increasingly the giant that turns the earth inside out—bringing a continuous stream of coal, ore, rock, and minerals to the surface to feed the voracious appetite of industry throughout the world. As the products of the mine and quarry emerge, various methods of transportation to storage, or usage, also become available. Whether barge, railroad, tramway, truck, or belt haul this tonnage on its next and subsequent journeys will in most cases be decided at each step by the lowest cost per ton mile.

[1]Presented before the Washington Rubber Group, Washington D. C., Feb. 15, 1956.

Belt Conveyor Development—1890 to Date

Let's peer into the past long enough to see why the belt conveyor has developed to the point where an overland haul of coal and iron ore of more than 100 miles has been explored and found practical by competent and conservative engineers.

In the 1890's, Thomas Robins made two tremendous steps forward in the serviceability and utilization of belt conveyors. He protected the tension-carrying carcass of the belt with a wear-resistant rubber cover, having discovered by experimentation that rubber withstood the cutting and abrasion of rock much better than fabric, in fact much better than steel. Then he invented a practical idler which would bend the edges of the belt upward, eliminating the severe wear from close fitting skirtboard used to hold the material on a flat belt. (See Figure 1.) From these improvements sprang the general usage of belt conveyor systems from hopper to crusher, crusher to further processing, to and from storage, to and from blending, to car and barge loading tipple.

It remained for belts and equipment of the 1920's to show what could be done in long-distance hauling. The

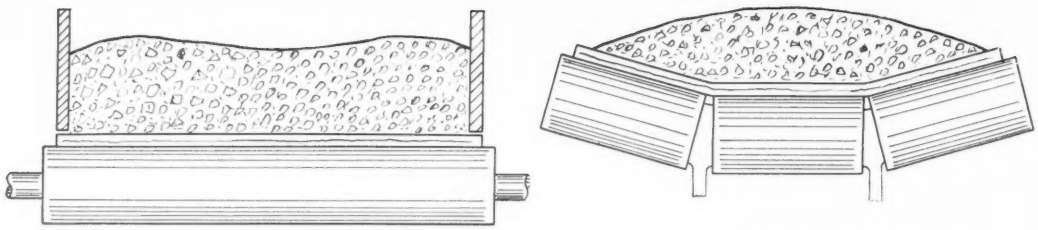

Fig. 1. Original flat belt conveyor with close fitting skirtboard *(left)*. Thomas Robins' idler bent edges of belt upward and eliminated need of skirtboard to hold material on belt *(right)*

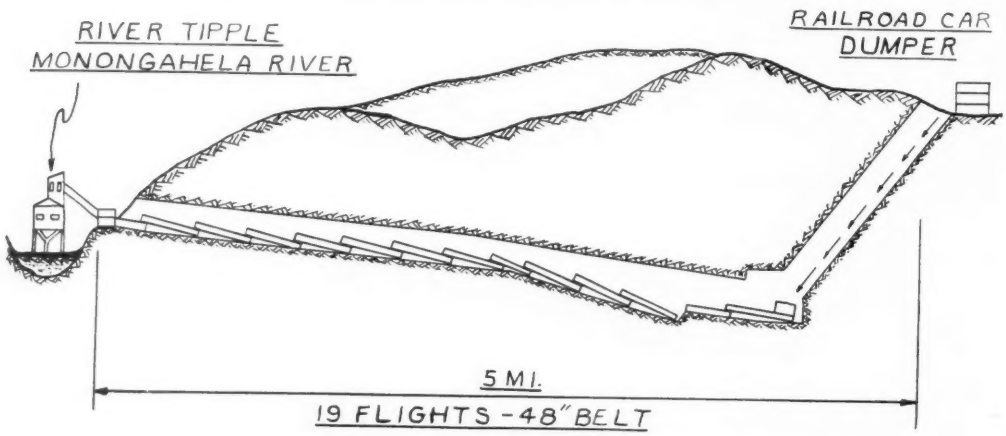

Fig. 2. The Colonial Dock installation of H. C. Fricke Coke Co. of the 1920's which consisted of five miles of belt conveyors for coal handling. More than 85 million tons of material handled in 30 years at less than estimated cost

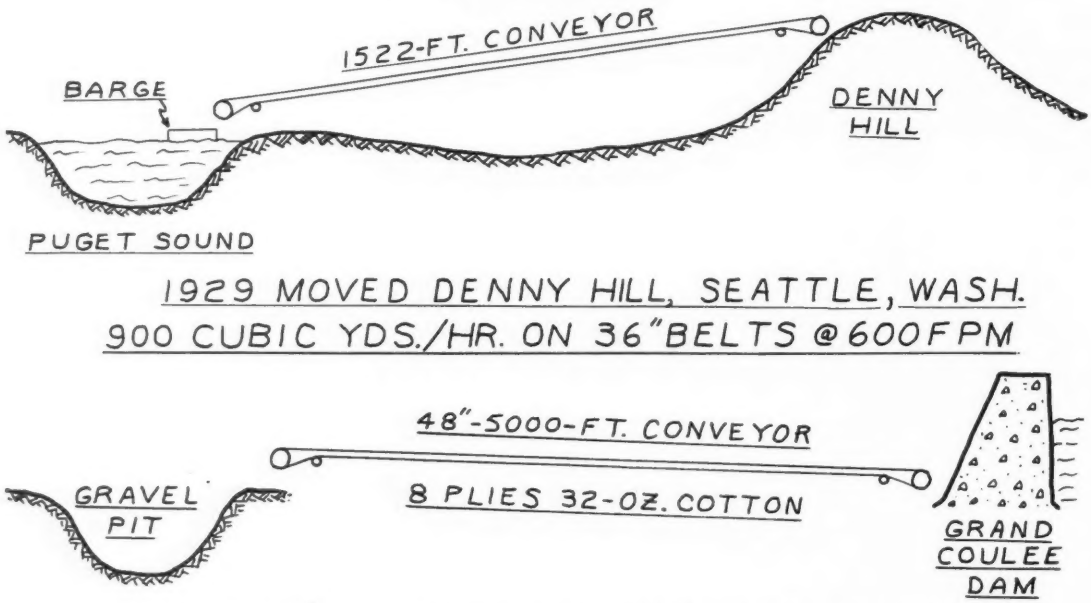

Fig. 3. Denny Hill in Seattle, Wash., was removed with the help of a belt conveyor in 1929 in 300 working days *(top)*. A 2,880-foot system; longest single flight, 1522 feet. One mile of belt conveyor used in 1930's in transporting aggregate in connection with the building of the Grand Coulee Dam *(bottom)*

The Author

F. W. Blanchard is a graduate of Lehigh University, where he received a B.S. degree in mechanical engineering. He joined Hewitt-Robins in Buffalo, N. Y., in 1936, where he subsequently became plant engineer, chief engineer, and factory manager. In 1953 he was made manager of operations for the industrial rubber division.

As recently as April of this year Mr. Blanchard was appointed to the newly created position of assistant to Executive Vice President Austin Goodyear and will work closely with Mr. Goodyear in the administration and coordination of the company's industrial products divisions and engineering organization.

Colonial Dock, and later the Palmer Dock, installations of the H. C. Frick Coke Co. handled run of mine coal underground for nearly five miles from bunker to barge tipple on nineteen 48-inch belts; the longest flight was 2,439 feet. (See Figure 2.) Thirty years of service, handling more than 85 million tons at less than estimated cost, has proved this installation to have been a proper choice.

In 1929 the City of Seattle was determined to rid itself of a small mountain which towered annoyingly between its business and residential districts. The problem was the formidable one of moving Denny Hill across part of the city and dumping it into Puget Sound. Mohammed, long ago, had part of the answer—move the mountain, but how? All contractors except one proposed removal by hydraulic sluicing. George Nelson & Co. entered a bid based on belt haulage over a 2,880-foot system (longest single flight, 1,522 feet). Unperturbed by scoffing competitors he won the contract, and some 300 working days later moved the last of Denny Hill down Battery Street to the waiting scows. A new era of long distance haulage above ground by belt conveyors had begun. (See Figure 3.)

Then opened the decade of the great dams. Long line belts proved themselves repeatedly at Grand Coulee, Shasta, Friant, Anderson, Boysen, Hungry Horse, Canyon Ferry, and Bull Shoals. Some of these projects represent real milestones in the progress of belt haulage overland.

In the mid-30's, a 48-inch belt of eight plies of 32-ounce cotton duck carried 2,000 TPH of aggregate on a slight decline nearly one mile in a single flight to help in building Grand Coulee Dam, as shown also in Figure 3.

To move 12,700,000 short tons of aggregate during four years of construction of Shasta Dam, Coram, Calif., in the early 1940's a 9.6-mile cross-country conveyor belt system consisting of 26 flights of 36-inch conveyors was installed from gravel pit to dam site. Longest flight was 3,415 feet. (Figure 4.)

It was at Shasta that the "rubber railroad" made history in successfully competing for a $7,000,000 haulage contract against the Southern Pacific Railroad. Shasta performance exceeded the most optimistic estimates by hauling its material at 7½ ¢ less per ton than the railroad estimate. At the end of the job its entire $1,750,000 cost had been charged off, and only one-sixth of the belts' top covers had worn away. The owners had no trouble disposing of belt and equipment in the postwar market for nearly 80% of its original cost.

A 4,000,000-ton mountain was moved seven miles

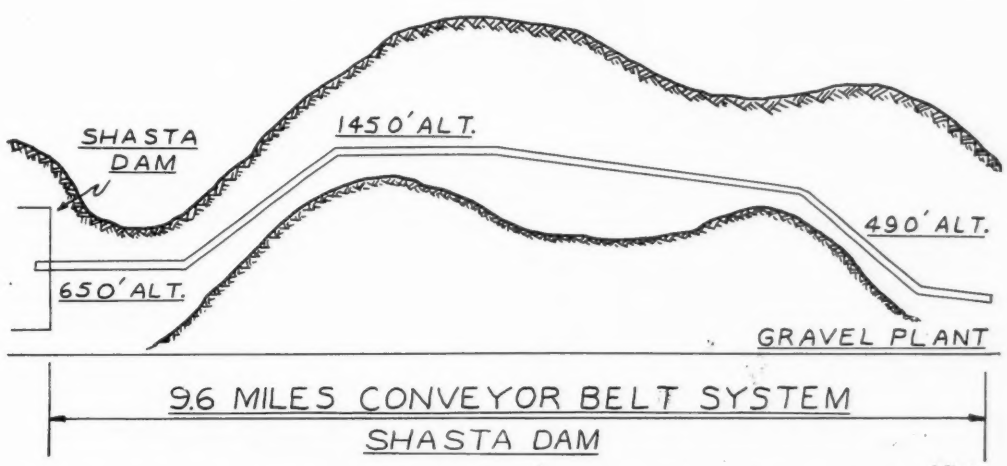

Fig. 4. Shasta Dam construction aided by 9.6-mile cross-country conveyor belt system. Performance very satisfactory, and 80% of original $1.75 million cost of system recovered when job was finished

across two valleys to provide crushed stone for constructing the $78,000,000 Bull Shoals Dam across the White River in Arkansas between 1948 and 1950. Twenty-one flights of 30-inch conveyor carried the six-inch-minus limestone from quarry to dam at 525 FPM. Figure 5 is a view of a part of this installation.

From 1920 to 1950 the standard heavy-duty conveyor belt for all types of service was reinforced with cotton duck, 32-, 42-, or 48-ounce, depending upon the unit tension and width required. The maximum allowable stress for a cotton duck belt is about 65 pounds per inch per ply. First-grade natural rubber covers, 50 to 60 durometer hardness, and approximately 3,500 psi. tensile strength, were bonded to these tension-members to provide a tough, long-life belt. Such a belt 30 inches wide will move 400 tons per hour horizontally about 1½ miles, or up an 18-degree incline 750 feet to 230-foot height. Today fabrics are available that will move this load 5¾ miles horizontally, or 2,690 feet to 830-foot height in a single flight and still trough properly in a 30-inch width, as shown in Figure 6.

A score of long-length, high-lift belts reinforced with steel cables where the loadings, or special conditions justified the higher initial and replacement costs of this special high-tension construction, have been installed. National Steel Corp. has operated a 10,000-foot C to C (center to center of pulleys) horizontal coal conveyor at Weirton, carrying coal through a mountain from mine dump to river barge tipple. (See Figure 7.)

Fig. 5 "Rubber Railroad" at Bull Shoals Dam project, Fiippin, Ark. Conveyor consisted of 21 separate flights and carried 650 tons per hour of crushed rock at 525 feet a minute

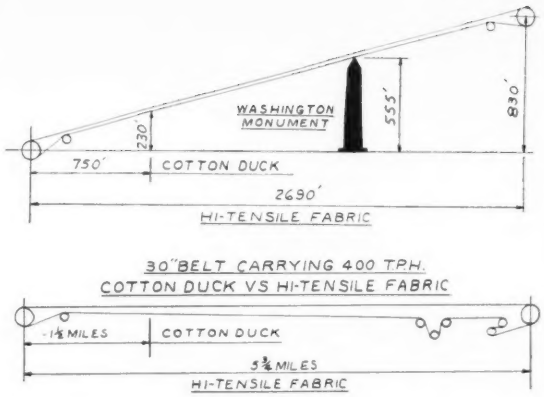

Fig. 6. Comparison of cotton duck *versus* high-tensile fabrics for belt conveyors. Cotton duck belt will move 400 tons of material horizontally about 1½ miles; while high-tensile fabric belt will move this material 5¾ miles *(bottom)*. Cotton duck belt will move 400 tons up 18-degree incline 750 feet to 230-foot height. High-tensile fabric belt will move 400 tons 2,690 feet to 830-foot height

Recently National Gypsum installed a 2,065-foot 30-inch slope belt at its new Shoals, Ind., mine to lift 350 tons per hour up 610 feet, also shown in Figure 7. This belt will operate at tensions as high as 200 lbs./in./ply of its high-tensile synthetic rayon fabric. Such a belt rivals the strength of steel while retaining the advantages of elasticity and lower cost.

Indeed, just as the two ribbons of steel converging in the distance were viewed by past generations, the ribbon of rubber speeding out of sight over the hill on its bed of tireless idler rollers carrying ton after ton of coal, ore, stone, or aggregate at speeds up to 1,000 FPM has become a commonplace industrial and construction picture.

Need of New Conveyor Data

As engineers have designed belt conveyor systems into more and heavier services, and as metallurgists and chemists have developed a never-ending parade of new materials with varying properties, conveyor engineers have needed more accurate and flexible design data and formulae to fit together the best combination of conveyor components for each application. Although the basic elements of such a system are still the belt, supporting idlers, pulleys and trippers, drive, and supporting structure—the design and specification of these is based on an analysis of the power required to overcome the several resistances and loads—these can be computed as six load components: (1) move empty belt over idlers; (2) move load horizontally; (3) lift (or lower) load; (4) turn pulleys; (5) tripper losses; (6) drive losses.

Good data are available on the last four items. Energy to lift (item 3) is directly calculatable as foot-pounds per minute. Power to turn pulleys, operate tripper, and operate gearing has been accurately computed by each manufacturer (items 4, 5, and 6).

Although it has long been known that idler spacing,

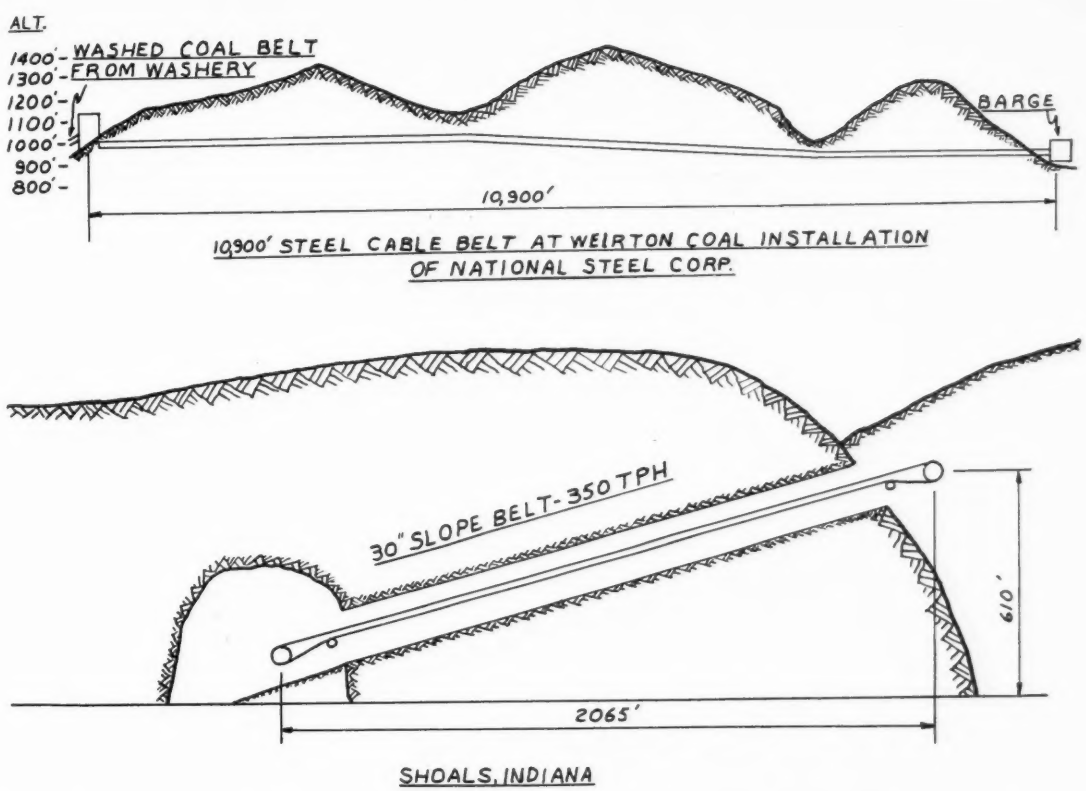

Fig. 7. National Steel's 10,900-foot steel cable belt for transporting coal *(top)*. *(Bottom)* National Gypsum high-tensile strength rayon fabric belt installation at Shoals, Ind., mine handles 350 tons per hour up 610 feet

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TABLE 1

Example of HP and belt requirements calculated using two formulae (A and B) in common current use, and using Formula (C) based on the Penn State findings:

Wt Mtl—Load Section = 220 lbs. per foot of belt

Assume, Belt width, 48 inches
Length, 1,800 feet C to C
Tons per hour—3000
Material 150 lbs./cu.ft — 6-inch ore
Belt wt, 20 lbs./ft.
Speed, 450 FPM
Lift— 0 in Case I (horiz. load)
75 in Case II (vert. lift)
600—6-inch trough idlers
180—6-inch return idlers
200° drive contact
Gravity take-up at head

Formula A	Case I— Horizontal	Case II— 75-Ft. Lift
Empty belt and load HP =	169.1	169.1
Vertical lift HP =	0	228.0
Total HP =	169.1	397.1
Tension T_1 in lbs./in.	351 lbs./in.	835 lbs./in.

Formula B	Case I— Horizontal	Case II— 75-Ft. Lift
Empty belt HP =	37.8	37.8
Horiz. load =	132.0	132.0
Vertical lift =	0	228.0
Total HP =	169.8	397.8
Tension T_1 in lbs./in.	351 lbs./in.	835 lbs./in.

Formula C	Case I— Horizontal	Case II— 75-Ft. Lift
Return strand =	8.5	8.5
Load. strand HP =	156.0	100.0
Vertical lift HP =	0	228.0
Total HP =	164.5	336.5
Tension T_1 in lbs./in.	341 lbs./in.	689 lbs./in.

Note that for the horizontal conveyor system there is very little difference in HP calculations, but when the tension is increased to elevate the load 75 feet, the more detailed analysis of the Penn State formula indicates an HP requirement of 61 HP less than the other two calculations, or a working tension in the belt of 689 pounds per inch of width rather than 835 lbs per inch of width.

Note that for the horizontal conveyor system, Case I, there is very little difference in HP calculations resulting from use of the three formulae. When the belt tension is increased to elevate the load 75 feet as in Case II however, the more detailed analysis of the Penn State (Hewitt-Robins) formula results in a computed HP of 61 HP less than the other two calculations, equivalent to a working tension in the belt of 689 pounds per inch of width instead of 835 pounds per inch of width. The first two formulae make no allowance for the reduction in that component of HP required to move the loaded belt over the idlers when the belt is pulled taut by the greater tension required for lifting. Formula C indicates a six-ply belt instead of a seven-ply belt could safely be used with accompanying savings in initial cost and operating cost.

belt tension, belt stiffness, and idler friction all affect the power required to move a belt conveyor and its load, until recently the variation in these factors due to differences in belt construction, type of load, type of idler and spacing, have been more or less lumped together in formulae developed from measuring actual overall power consumption on many installations under varying conditions. Such formulae were evolved to produce the total power that operating experience indicated.

This approach, while effecting workable designs, had so many unknown variables combined into one constant that, from experience, it was necessary to be conservative in application, or gamble that occasionally a combination of factors would produce an underpowered system. Consequently most systems in the past have been overpowered and overbelted, with resultant higher initial cost and higher operating cost than necessary.

New Belt Use Formula

In June, 1953, under a grant by Hewitt-Robins, Penn State University began an investigation of the effect of these various factors at its Minerals Industries Experimental Station. It developed techniques to analyze separately the power consumed by troughing idlers, return idlers, return strand of belt, and the carrying belt, both loaded and unloaded. It then checked its findings by gathering detailed data on 19 conveyor installations under varying loading and weather conditions. It found that idler resistance (resistance to turning) had far less effect on power consumption than had been supposed, and that idler spacing and belt tension had a sizable effect on power required. This latter power is absorbed in flexing the belt between idlers and in "squeezing" the load (shifting and lifting) at each troughing idler.

A formula has been developed which permits the engineer to provide the proper power component for each of these four factors:

$$T_E = N_1 I_1 + N_2 I_2 + K_1 LB + K_2 L (B + M)$$

T_E = Effective tension
N_1 = no. return idlers
N_2 = no. troughing idlers
I_1 = resist. return idlers
I_2 = resist. trough idlers
K_1 = resist. return belt
K_2 = resist. trough belt & load
B = lineal wt. of belt
M = lineal wt. of load
L = length of conveyor

A definite relation exists between the belt construction, tensions, idler spacing, and HP required. See Table 1 (on page 231).

With the advent of reinforcing materials which, for a given bulk, weight, and unit cost, are stronger than cotton, the engineer has a new variable which affects both the lateral strength and stiffness of the belt, and the allowable unit tension to which the belt can be safely subjected. Whereas a few years ago the working tension, and therefore the length and the lift of a conveyor, were limited by the number of plies of available material which could be laminated and still retain enough lateral flexibility to trough, today's high tensile rayons, treated cottons, and other synthetic fibers make possible belts for much longer flights and higher lifts while retaining suitable troughing flexibility by control of plies and fabric design.

Belt Conveyors of Tomorrow

Riverlake

The best illustration of the practicability of the long overland belt conveyor as a major hauler of bulk material between distant points is the proposed Riverlake project. (See Figure 8.) Extending from Lake Erie, near Cleveland, 103 miles to the Ohio River at Midland (below Youngstown), it represents pioneering in several areas.[2]

For the first time a belt conveyor will require public recognition and acceptance as a common carrier. For the first time a two-way haul of large tonnages over long distances will be operated. The problems of synchronizing stops and starts and controlling "creep" of a unit requiring thousands of horsepower and containing thousands of tons of moving mass will be encountered and overcome.

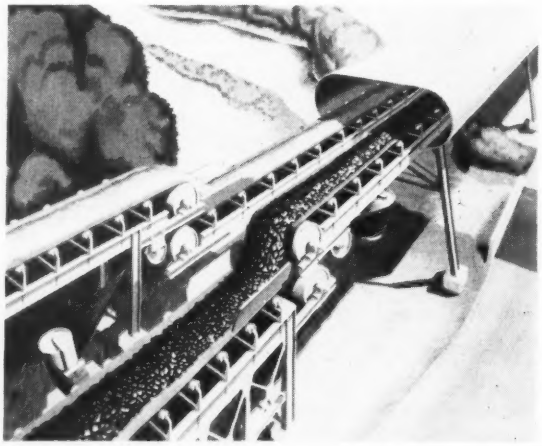

Fig. 8. Artist's conception of part of the proposed Riverlake "Rubber Railroad" in Ohio

Even the controversy between the railroads and Riverlake project has been favorable to the "Rubber Railroads" since it has highlighted both the advantages and limitations of the belt conveyor system. On the negative side it is clear that a long-distance belt will not displace railroads for general haulage. Belts cannot be profitably operated to handle television sets one hour, crates of eggs the following hour, and then Texas cattle the next hour.

Since estimates indicate that Riverlake conveyor must haul at least 57% of its 50+ million ton capacity to break even, it is obvious that such a system is limited to those situations where large tonnages are required almost continuously. On the other hand, it will demonstrate conclusively that where the volume is available, a very small load per lineal foot hustling along at 600 FPM can run up astounding tonnage figures per 24 hours. A 36-inch belt carrying 2,400 tons of ore per hour will move 57,600 tons a day. Working just one week, this medium-size conveyor will haul a 400,000-ton pile of ore, or enough to fill 5,700 gondola cars.

[2] India RUBBER WORLD, Mar., 1949, p. 740.

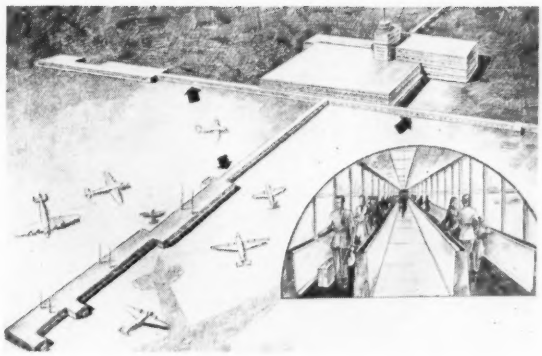

Fig. 9. Artist's conception of Love Field, Dallas, Tex., air terminal equipped with moving sidewalks at locations indicated by arrows

Passenger Conveyors

Many times you have been one of a stream of men and women in a railroad station, at an airport, in a large shopping center, walking relentlessly, and laboriously toward some common goal—an exit to the street, a parking lot, a loading pier, a baggage counter. Perhaps you were one of those with both arms filled with packages, or luggage in each hand—airport loading piers and railroad platforms seem endless at times like these.

Fortunately, where the distances are greatest and the traffic heaviest, an "assist" to these laden travelers is most practical. A passenger conveyor system which will effortlessly and safely transport people and their hand luggage at a medium walking pace (about 1⅔ MPH) up seven-degree inclines, around curves (22- to 25-foot radius) from parking lot, or bus terminal to waiting plane or train is a reality.

The City of Dallas, Tex., in its new facilities at Love Field is installing 1,500 feet of passenger conveyor to carry customers in both directions the length of its three 260-foot loading piers. Passengers may enter or leave the conveyor at loading points more easily than using an escalator. Figure 9 is an artist's conception of this installation.

A major eastern airport is seriously planning passenger conveyors from parking space to service areas.

The "Glide Ride"[3] passenger conveyor carries its standing patrons on a rubber belt supported by steel pallets in a continuous chain. This system prevents a feeling of motion under the feet (one can feel rollers no matter how closely spaced), and permits four-way change of direction—incline, decline, left turn, or right turn—this is not possible with an unmounted belt running on rollers. The pallets run quietly and smoothly on rubber tired wheels. The belt can be turned around in a reasonable space so that the same unit can be used for travel in the opposite direction.

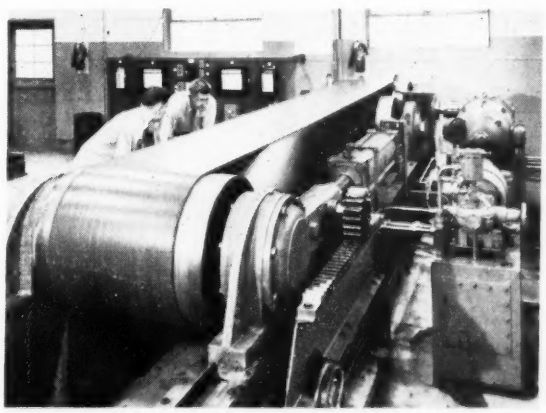

Fig. 10. Hewitt-Robins belt testing dynamometer. The belt sample can run at speeds up to 1,000 feet a minute and can be tensioned to a maximum of 150,000 pounds or a maximum of about 3,000 pounds per inch for a 44-inch belt. A wear test equivalent to eight years of service can be achieved in six weeks on this machine

Summary and Conclusions

Continued technological advance, expanded research and development activity, and improved testing and analyzing facilities will assuredly open the door still wider to the variety of applications, and to greater serviceability of belts and conveyor systems.

Reinforcing materials of suitable flexibility and greater strength are already under test in the laboratory and on "pilot" installations.

Better testing and experimental facilities will be devised, like the H-R belt testing dynamometer recently installed, which will drive a 30-inch wide by 42-feet long belt up to 1,000 FPM over 24-, 36-, and 48-inch pulleys at loadings up to 45 tons per strand. For analyzing flexing life of splices and constructions on a full-scale belt, this unit has already added much to the engineer's available information. (See Figure 10.)

Belt covers made from new formulae and as yet undeveloped polymers will offer increased resistance to abrasion, cutting, tearing, weathering, heat, cold, oils, and chemicals.

Better adhesives will assist in preventing delamination of covers and plies from severe service, or accident.

Increased volume and standardization will permit economies in manufacturing and distribution to further the economical use of belt conveyors.

An "infant" of but a few years ago, the "rubber railroad" is now exercising its "adolescent" prerogative of searching hitherto "unexplored" fields with the energy and enthusiasm of youth. While this "youngster" is dreaming restlessly of "castles" a little beyond its presently available equipment and capacity, its pioneering accomplishments will continue to amaze some of its elders, while annoying others. We can safely predict continued rapid growth and long life for this "youngster" wherever quantities of congruent units, whether bulk or package materials (or even human beings), require (or desire) smooth, gliding, uninterrupted transportation from loading station to distant destination.

[3]Hewitt-Robbins, Inc., trade name.

Effect of Cure on Low-Temperature and Aging Properties of Nitrile Rubbers[1]

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The relative effectiveness of various levels of vulcanizing agents in a sulfur-accelerator curing system and a thiuram-disulfide type of curing system, on the relation among heat resistance, oil resistance, and low-temperature serviceability of nitrile type synthetic rubbers, is covered in this paper.

The best balance among heat resistance, oil resistance, and low-temperature properties was found in the stock cured with 3 phr of tetramethyl thiuram disulfide and 0.2 phr of sulfur.

For sulfur cured stocks, the best balance of properties was obtained with 2 phr of sulfur.

Thiuram cured stocks showed better balance of properties after aging than sulfur cured stocks.

DURING recent years, military applications of rubber have constantly stressed low-temperature properties and oil resistance. For Arctic applications, equipment must operate in the presence of oil, yet be serviceable in extremely low temperatures. It has been generally recognized for some time, however, that oil resistance and low-temperature serviceability are contradictory properties. That is, improvement in one is normally gained only at the expense of the other. Therefore, there has been an increasing emphasis on improving the balance between these two properties.

A third facet has been added to the problem owing to the development of very high temperatures in operating aircraft because of heat generated by friction at high speeds. Improvements have been made on the heat resistance of rubber compounds by the use of improved antioxidants and low-sulfur cures. These low-sulfur cures often contain thiuram disulfides. Little or nothing has been published, however, on the relation between heat resistance and the balance between oil resistance and low-temperature serviceability.

One of the tests frequently used to evaluate low-temperature serviceability is the temperature-retraction test.[2,3] There has been some evidence in recent work that the temperature-retraction data might be more dependent than the oil resistance upon the cure of the stock. If this point is true, then the balance of oil resistance and low-temperature properties would be a function of the cure.

Experimental Details

The object of this investigation was to establish the relative effectiveness of various levels of the vulcanizing agents in a conventional sulfur-accelerator curing system and a thiuram-disulfide type of curing system, on the relation among heat resistance, oil resistance, and low-temperature serviceability of nitrile-type synthetic rubbers. The recipes used are shown in Table 1. It will be noted that the thiuram disulfide compounds contain 0.2 phr of sulfur as is generally considered good practice from the standpoint of mechanical properties. The two compounds are, of course, identical except or the curing systems.

TABLE 1. RECIPES USED

Ingredients	Recipe A — Variable Sulfur	Recipe B — Variable Tuads, Low Sulfur
Paracril B*	100	100
Statex B† FF carbon black	40	40
Zinc oxide	5	5
Stearic acid	1	1
DOP	10	10
AgeRite Resin ‡	1	1
Sulfur	Variable (0.5-4.0)	0.2
Altax ‡	1.75	3
Methyl Tuads ‡	—	Variable (1.0-5.0)

Cures: 20, 40, and 80 minutes at 292° F.

* Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.
† Columbian Carbon Co., New York, N. Y.
‡ R. T. Vanderbilt Co., New York, N. Y.

A major factor under consideration was the influence of the degree of cure, as affected by changing the amount of curing agent used, on the three environmental-resistance properties. For this reason, each compound was tested at five levels of curing agent. These ranged from 0.5 phr to 4.0 phr for sulfur in the sulfur-accelerator-containing compounds and from 1.0 to 5.0 phr of thiuram disulfide in the compounds containing this curing agent.

A further variation involved the use of control stocks (Table 2) of three oil-resistant synthetics having dif-

[1] Presented before the Division of Rubber Chemistry, ACS, May 4, 1955.
[2] O. H. Smith, W. A. Hermonat, H. E. Haxo, A. W. Meyer, *Anal Chem.*, 23, 322 (1951).
[3] ASTM Test Method D1329-54T, "ASTM Standards on Rubber Products, December, 1954," p. 579. American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

TABLE 2. PHYSICAL PROPERTIES OF CONTROL STOCKS

	Recipe No.*	11			20			17			8			13			14		
Cure, minutes at 292° F.		20	40	80	20	40	80	20	40	80	20	40	80	20	40	80	20	40	80
Unaged Physical Properties																			
200% Modulus, psi.		660	630	680	380	400	410	390	470	500	440	450	430	480	650	810	400	380	570
Tensile strength, psi.		2100	1950	2050	1270	1170	1200	2880	2750	2760	2090	1750	2130	2960	2530	2190	1770	1690	1660
Elongation, %		390	360	360	360	330	320	580	570	470	480	420	470	550	430	350	440	430	410
Hardness, Shore A		53	53	54	52	52	52	53	55	56	47	47	48	55	57	58	52	53	53
Swell in SR-6, 24 hr. at room temp.		85.7	87.3	86.6	98.6	95.5	95.3	73.4	70.6	68.5	70.6	70.0	69.6	40.5	39.4	38.5	40.8	39.7	39.7
TR10, °C.		—42.3	—40.8	—40.5	—42.5	—42.8	—43.3	—36.0	—34.8	—33.7	—36.2	—35.2	—35.2	—31.7	—26.5	—26.1	—28.0	—27.6	—27.6
TR30, °C.		—38.1	—37.0	—36.6	—39.9	—38.9	—39.3	—30.9	—28.8	—29.3	—30.8	—30.4	—30.3	—23.3	—21.9	—22.0	—22.8	—23.0	—22.9
TR50, °C.		—34.4	—32.6	—32.5	—37.4	—35.9	—36.1	—27.6	—27.0	—26.2	—27.8	—27.7	—27.4	—20.2	—19.1	—19.6	—19.5	—19.8	—19.6
TR70, °C.		—30.0	—26.4	—27.1	—32.6	—30.7	—32.2	—23.9	—22.5	—22.4	—23.4	—23.8	—22.8	—16.6	—15.4	—17.1	—15.5	—16.0	—15.6
Properties after Aging 70 Hours at 250° F.																			
200% Modulus, psi.		——	——	——	830	900	880	——	——	——	1150	1050	990	——	——	——	1240	1080	1050
Tensile strength, psi.		1320	1310	1420	1390	1430	1240	1810	2150	2050	1760	1890	1960	1850	2240	1990	1640	1490	1540
Elongation, %		130	140	150	260	260	240	160	190	190	260	280	290	170	180	190	240	240	250
Hardness, Shore A		67	67	67	57	57	57	67	68	67	60	59	59	68	68	67	62	62	61
Swell in SR-6, 24 hr. at room temp.		67.1	69.7	71.6	87.2	88.0	87.8	58.6	56.7	57.1	63.4	64.2	63.5	37.5	36.3	37.3	38.9	39.4	39.1
TR10, °C.		—38.2	—37.3	—38.1	—41.9	—42.1	—39.0	—33.0	—32.5	—31.3	—34.0	—34.1	—33.6	—22.7	—22.6	—22.8	—26.0	—26.2	—25.9
TR30, °C.		—33.9	—32.0	—32.5	—37.2	—38.0	—30.8	—26.9	—27.3	—27.1	—29.2	—29.0	—29.9	—18.2	—17.9	—18.3	—21.6	—21.8	—21.8
TR50, °C.		—29.8	—27.7	—28.9	—34.5	—34.8	—29.0	—27.0	—24.6	—23.6	—26.3	—25.6	—25.8	—15.8	—15.1	—15.6	—18.6	—19.0	—18.9
TR70, °C.		—26.1	—18.3	—23.4	—30.6	—31.0	—27.2	—18.0	—19.5	—17.9	—22.4	—19.7	—21.1	—12.4	—9.8	—11.1	—14.7	—15.0	—15.2

* Recipe 11, Recipe A with 2.0 phr sulfur and Paracril 18-80 (moderate oil resistance) substituted for Paracril B.
Recipe 20, Recipe B with 3.0 phr Methyl Tuads and Paracril 18-80 substituted for Paracril B.
Recipe 17, Recipe A with 2.0 phr sulfur.
Recipe 8, Recipe B with 3.0 phr Methyl Tuads.
Recipe 13, Recipe A with 2.0 phr sulfur and Paracril 35NS90 substituted for Paracril B.
Recipe 14, Recipe B with 3.0 phr Methyl Tuads and Paracril 35NS90 substituted for Paracril B.

P. B. Stickney

The Authors

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W. J. Mueller

TABLE 3. PHYSICAL PROPERTIES OF VARIABLE-SULFUR STOCKS

Recipe No.	15			16			17			18			19		
Sulfur, phr*	0.5			1.25			2			3			4		
Cure, minutes at 292° F.	20	40	80	20	40	80	20	40	80	20	40	80	20	40	80
Unaged Physical Properties															
200% Modulus, psi.	90	120	120	230	250	290	390	470	500	590	780	880	820	1160	1330
Tensile strength, psi.	1200	1460	1730	2560	2980	2910	2880	2750	2760	2900	2600	2800	2820	2870	2540
Elongation, %	840	820	790	700	690	640	580	510	470	480	380	370	400	340	290
Hardness, Shore A	46	48	50	50	53	53	53	55	56	57	58	59	60	62	63
Swell in SR-6, 24 hr. at room temp.	98.3	93.8	92.2	81.5	79.3	78.6	73.4	70.6	68.5	65.6	63.0	63.1	61.7	57.8	57.2
TR10, °C.	—35.7	—36.3	—35.5	—36.1	—35.6	—34.2	—36.0	—34.8	—33.7	—34.9	—32.5	—31.9	—33.4	—31.8	—29.7
TR30, °C.	—29.6	—30.9	—30.0	—31.1	—29.4	—29.6	—30.9	—28.8	—29.3	—29.4	—29.0	—27.3	—28.7	—27.7	—26.3
TR50, °C.	—22.8	—25.1	—25.0	—27.2	—27.2	—26.3	—27.6	—27.0	—26.2	—27.0	—26.4	—25.5	—26.0	—24.8	—24.5
TR70, °C.	—11.2	—14.2	—14.5	—21.0	—21.9	—20.5	—23.9	—22.5	—22.4	—24.0	—22.5	—22.3	—23.7	—21.9	—21.5
Properties after Aging 70 Hours at 250° F.															
200% Modulus, psi.	560	490	410	1570	1510	1230	—	—	—	—	—	—	—	—	—
Tensile strength, psi.	2090	1970	960	1870	2520	1780	1810	2150	2050	1680	1660	1740	1340	1470	1390
Elongation, %	390	400	470	220	280	240	160	190	190	120	120	130	90	90	90
Hardness, Shore A	56	57	57	63	63	63	67	68	67	70	71	71	75	75	75
Swell in SR-6, 24 hr. at room temp.	74.9	77.2	81.2	64.6	65.9	66.7	58.6	56.7	57.1	52.0	52.2	54.0	50.8	49.3	50.8
TR10, °C.	—35.0	—33.7	—37.3	—32.8	—33.2	—31.4	—33.0	—32.5	—31.3	—27.7	—28.7	—28.0	—21.0	†	—22.4
TR30, °C.	—30.2	—29.7	—29.2	—28.5	—29.3	—27.8	—26.9	—27.3	—27.1	—23.1	—23.5	—23.8	—16.9	—	—19.2
TR50, °C.	—26.3	—26.3	—24.7	—25.5	—25.9	—23.7	—27.0	—24.6	—23.6	—18.4	—20.5	—20.2	—13.9	—	—16.6
TR70, °C.	—17.4	—19.0	—16.0	—18.0	—19.4	—15.0	—18.0	—19.5	—17.9	—12.5	—15.4	—15.0	—11.0	—	—11.3

* Recipe A used (see Table 1) with sulfur loadings as shown. † Unable to test sample.

ferent nitrile contents. This was done in order to relate the variations in oil resistance and low-temperature serviceability obtained by varying the amount of the curing agents to those obtainable by varying the nitrile content of the polymer.

The experimental methods used in this study were:

Compounding and Curing. ASTM procedures were used, except that the mixing of some series of compounds was performed in a laboratory Banbury mixer.

Mechanical Properties. ASTM procedures.

Oil Resistance. Volume swell after 24 hours in SR-6 fluid at room temperature.

Low-Temperature Serviceability. ASTM Test D-1329-54T.[3] The test is carried out by (1) elongating the specimen, (2) locking it in the elongated condition, (3) freezing it to practically a non-elastic state, (4) releasing the frozen specimen and allowing it to retract freely while the temperature is being raised at a uniform rate, (5) reading the length of the specimen at regular temperature intervals while it is retracting, and (6) computing the percentage retraction values at these temperatures from the data obtained.

In practice, the temperatures corresponding to 10 and 70% retraction are of particular importance and are designated as TR10 and TR70, respectively. Samples were stretched to 55% of the breaking elongation.

High-Temperature Serviceability. Samples were aged 70 hours at 250° F. in test tubes in an oil bath. Aged mechanical properties were determined. The emphasis has been placed, however, on the oil resistance and low-temperature serviceability of aged samples.

Results and Discussion

Table 2 shows the properties of the control recipes for each of the three nitrile levels and both types of cure. The compounds containing 2 phr of sulfur or 3 phr of Tuads were taken as the controls, that is, as representative of approximately optimum cure.

At these levels of the curatives, the two types of cure give practically equivalent oil resistance and low-temperature serviceability, for each of the three different grades of nitrile rubber tested. While the low-sulfur cure appears to give a lower TR70 value with Paracril 18-80, the swell is correspondingly higher. Actually, when TR-70 and percentage swell are plotted for these six samples, they fall very well along one straight line. This line is shown in Figures 1-2, marked "Control."

It will also be noticed that the mechanical properties of the Tuads cures are initially poorer than those of the conventionally cured compounds. After aging, however, the low-sulfur compounds have better properties, particularly in hardness and elongation. These compounds also show relatively little change in swell and TR70 values compared to the conventionally cured stocks. That is, the well-known superiority of the thiuram disulfide type of cure in retention of aged properties includes excellent retention of low-temperature serviceability.

Conventional Cures

Table 3 and Figure 1A show the effect of varying the sulfur level on the oil resistance and low-temperature serviceability of the conventionally cured Paracril B

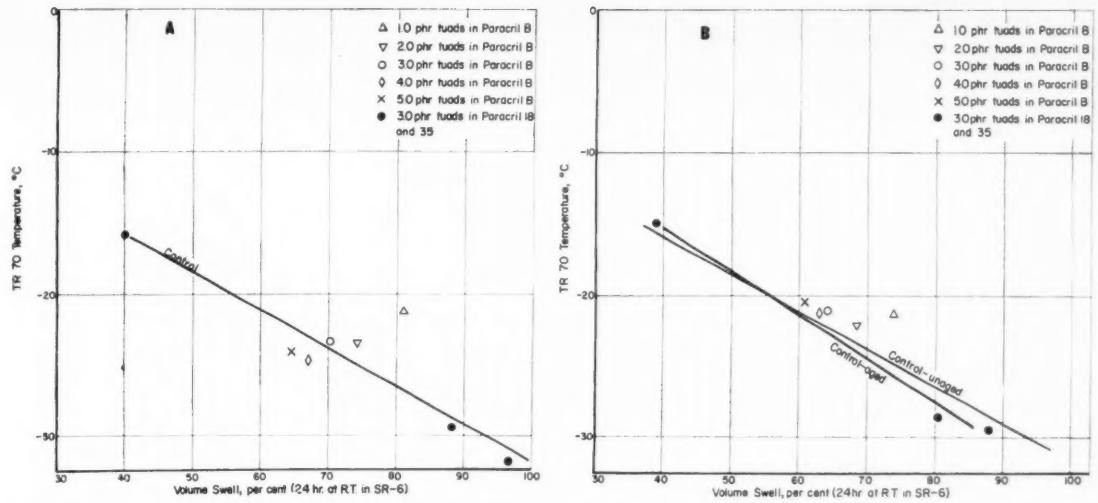
A
B
Δ 1.0 phr tuads in Paracril B
▽ 2.0 phr tuads in Paracril B
○ 3.0 phr tuads in Paracril B
◊ 4.0 phr tuads in Paracril B
× 5.0 phr tuads in Paracril B
● 3.0 phr tuads in Paracril 18 and 35
TR 70 Temperature, °C
Volume Swell, per cent (24 hr. at R.T. in SR-6)
Control
Control-aged
Control-unaged

Fig. 1. Effect of sulfur level on balance of oil resistance and low-temperature retraction properties for conventional sulfur cured stocks: A—before aging; B—after aging

compounds. The stocks containing 0.5 and 1.25 phr of sulfur were, as would be expected, obvious undercures as judged by the low 200% modulus and high elongation. Their TR70 values are higher than those for the stocks containing more sulfur. That is, presumably because of excessive set, the retraction test is a poor measure of low-temperature serviceability of undercures. Three and 4 phr of sulfur result in a reduction of swell over that obtained with 2 phr. This suggests that tightly cured samples give a slightly better balance of oil resistance and low-temperature serviceability, since the TR70 values change to a lesser degree. This effect is useful, of course, only insofar as the other required properties can be obtained with these cures.

Figure 1B shows the oil resistance and TR70 values of the conventionally cured stocks after aging. The point for the control stock, containing 2 phr of sulfur, still falls practically on the "Control" line derived from the data in Table 2. The undercures show some evidence of "postcuring" during aging, since both swell markedly less than the comparable unaged samples. The TR70 values, however, are still much higher than for 2 phr sulfur stocks having the same swelling behavior.

The tightly cured stocks containing 3 and 4 phr of sulfur both show marked increases in TR70 and considerably reduced swelling volumes. The former outweighs the latter, however, so that they definitely have a poorer balance of the two properties than the control. While the 2 phr stock still shows a good balance of properties, it has a TR70 four degrees higher than before this relatively mild aging. From a service standpoint, the stock is definitely deteriorating in low-temperature properties, as well as in mechanical properties.

Low-Sulfur Cures

Table 4 and Figure 2A show the unaged properties of the low-sulfur stocks containing varying amounts of Tuads. One of the obvious points to be seen is that

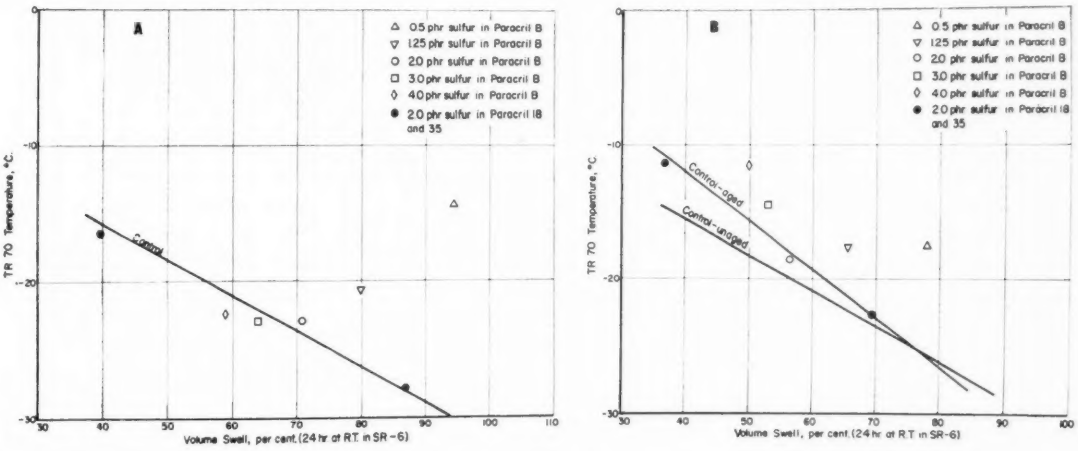
A
B
Δ 0.5 phr sulfur in Paracril B
▽ 1.25 phr sulfur in Paracril B
○ 2.0 phr sulfur in Paracril B
□ 3.0 phr sulfur in Paracril B
◊ 4.0 phr sulfur in Paracril B
● 2.0 phr sulfur in Paracril 18 and 35
TR 70 Temperature, °C
Volume Swell, per cent (24 hr at R.T. in SR-6)
Control
Control-aged
Control-unaged

Fig. 2. Effect of thiuram disulfide level on balance of oil resistance and low-temperature retraction properties for low sulfur stocks: A—before aging; B—after aging

TABLE 4. PHYSICAL PROPERTIES OF LOW-SULFUR VARIABLE-METHYL TUADS STOCK*

Recipe No.	6			7			8			9			10		
Methyl Tuads, phr	1			2			3			4			5		
Cure, minutes at 292° F.	20	40	80	20	40	80	20	40	80	20	40	80	20	40	80
Unaged Physical Properties															
200% Modulus, psi.	200	260	220	320	330	300	440	450	430	640	500	400	670	680	790
Tensile strength, psi.	1830	1990	2040	2050	2120	2090	2090	1750	2130	2080	1920	2090	1900	1880	1890
Elongation, %	660	620	640	550	540	540	480	420	470	410	400	450	370	360	340
Hardness, Shore A	42	43	43	44	45	46	47	47	48	49	49	49	51	51	52
Swell in SR-6, 24 hr. at room temp.	82.0	80.0	80.8	75.1	74.7	74.4	70.6	70.0	69.6	66.6	66.4	67.4	65.2	64.1	63.9
TR10, °C.	—45.0	—54.0	—45.0	—41.9	—38.1	—39.2	—36.2	—35.2	—35.2	—36.4	—35.4	—37.1	—35.6	—35.4	—34.6
TR30, °C.	—32.8	—33.5	—33.0	—33.3	—32.2	—32.4	—30.8	—30.4	—30.3	—31.2	—30.7	—31.5	—31.6	—31.5	—30.4
TR50, °C.	—27.6	—28.7	—28.2	—28.8	—28.1	—28.3	—27.8	—27.7	—27.4	—28.3	—27.9	—28.3	—27.7	—27.9	—26.8
TR70, °C.	—20.4	—22.7	—20.5	—24.4	—23.0	—23.7	—23.4	—23. 8	—22.8	—25.1	— 24.2	—24.9	—24.5	—24.7	—23.7
Properties after Aging 70 Hours at 250° F.															
200% Modulus, psi.	570	480	510	820	760	700	1150	1050	990	1370	1260	1130	1540	1550	1620
Tensile strength, psi.	2360	2180	2320	1920	2100	2030	1760	1890	1960	2020	1750	1840	1610	1690	1830
Elongation, %	430	440	450	320	350	350	260	280	290	250	240	260	210	210	210
Hardness, Shore A	54	55	55	57	57	58	60	59	59	61	61	60	62	61	62
Swell in SR-6, 24 hr. at room temp.	72.5	73.5	74.1	67.9	68.6	67.8	63.4	64.2	63.5	60.7	63.7	64.6	61.2	59.5	60.7
TR10, °C.	—35.9	—35.4	—35.9	—34.9	—35.3	—35.4	—34.0	—34.1	—33.6	—33.8	—33.8	—33.3	—31.8	—31.7	—31.7
TR30, °C.	—29.9	—29.8	—30.1	—29.7	—29.9	—29.9	—29.2	—29.0	—29.9	—28.8	—28.8	—28.6	—28.3	—27.9	—28.2
TR50, °C.	—27.2	—26.3	—26.7	—26.8	—27.0	—27.0	—26.3	—25.6	—25.8	—25.8	—25.8	—25.7	—25.0	—24.2	—24.8
TR70, °C.	—22.3	—19.9	—21.0	—22.2	—22.0	—22.1	—22.4	—19.7	—21.1	—21.3	—21.4	—21.6	—22.0	—19.6	—21.7

* Recipe B used (see Table 1) with Methyl Tuads loadings as shown.

these stocks do not cover so wide a range of cures as the conventional sulfur compounds. They do, however, show the same general trends. That is, swelling is reduced by increasing the level of curing agent used, and a somewhat better balance of oil resistance and low-temperature serviceability is obtained in the tight cures.

The TR70 and volume swell data for the same compounds after aging are shown in Figure 2B. Again the undercures show evidence of postcuring. The point for the control stock, that is, that containing 3 phr of Tuads, still lies practically on the line for the unaged controls. The tighter cures again show some loss in balance of low-temperature serviceability and oil resistance. However, the change is much less marked than in the case of the conventionally cured stocks.

Summary and Conclusions

(1) The best balance among heat resistance, oil resistance, and low-temperature properties was found in the stock cured with 3 phr Tuads and 0.2 phr sulfur (Recipe No. 8).

(2) For the sulfur-cured stocks, the best balance of properties was obtained at 2 phr sulfur.

(3) Tuads-cured stocks had a better balance of properties after aging than the sulfur-cured stocks. The former had essentially the same balance of oil resistance and low-temperature serviceability after aging as before; while the latter had a somewhat poorer balance. In addition, the Tuads cured stocks showed much less degradation of stress-strain properties during aging.

(4) Both types of cure appear to give slightly better balance of low-temperature serviceability and oil resistance at relatively high curative levels.

(5) Although TR70 values are often used to measure the low-temperature serviceability of a stock, this value is greatly dependent upon the state of cure. This test, therefore, must be regarded as most suitable for the elevation of a cured vulcanizate, rather than the base polymer.

(6) Undercured samples give poor TR70 values, presumably owing to excessive set. Calculation of the retraction on the basis of the length after total recovery rather than initial length might give more meaningful values in such cases.

Glass-Insulated Conveyor

What is said to be the first conveyor belt ever made with glass-fabric insulation has been announced by B. F. Goodrich Industrial Products Co., Akron, O. Designed for handling hot materials, the belt resists penetration by metal as hot as 1400° F., the company says.

Called Fire Curtain Belt, it is constructed of two plies of glass fabric embedded in rubber. The belt was originally developed for use in foundries where burnt holes are the major cause of belt failure.

EDITORIAL

What's in a Name?—Depends upon When and How Used!

WHAT'S in a name? In the rubber industry at the present time it depends upon when and how the name is used. *As a case in point, it is about time we stopped using the name 'Government Rubber-Styrene" and the more commonly known and used abbreviation "GR-S" for general-purpose butadiene-styrene copolymers.*

This term and this abbreviation were the designations given these rubbers as produced and sold under the Government Synthetic Rubber Program from 1943 through April, 1955. The majority of the government producing plants were sold to private industry in April, 1955, and with the sale of the plant at Baytown, Tex., in July, 1955, the production of GR-S, as such, ceased.

Nevertheless the term "Government Rubber-Styrene" and, more particularly, the abbreviation "GR-S" are still being used by both the producers and consumers of this-type rubber in verbal and written communications. Getting the government out of the rubber business was a primary objective of the whole industry since at least 1950, and now private industry has been the sole source of general-purpose butadiene-styrene rubbers for about a year. This product of private industry, however, is still referred to most of the time as "GR-S."

Of course, private producers have attached their own brand names to the butadiene-styrene rubbers they make, but there are about a dozen producing companies now and an equal number of brand names for the same type of rubber. It would seem to be to the industry's best interests to decide also on a generally acceptable generic term and abbreviation for this-type rubber as soon as possible. *Now that it is no longer "Government Rubber," let's stop calling it by that name.*

Working in the American Society for Testing Materials' Committee D-11 on Rubber, the editor of RUBBER WORLD proposed the term "styrene rubber" and the abbreviation "RS," but this abbreviation was rejected because of its similarity to the one for ribbed smoked sheets, "RSS." Two additional proposals made by others in the ASTM are now being considered. The first suggests only changing the abbreviation or coding from "RS" to "SR." The second suggests the use of the term "butadiene-styrene rubber" and the coding "SBR."

Meanwhile, since the "styrene-butadiene rubber" term and the "SBR" coding are considered to be the most descriptive and satisfactory proposals made to date, they are being adopted tentatively by RUBBER WORLD. We will be able to eliminate, therefore, the use of the awkward, cumbersome, and incorrect compromise terminology "GR-S type synthetic rubber," which has been our practice for the past several months. If a different terminology is finally found more acceptable to the industry, RUBBER WORLD will change again.

There is much more to the problem however, than working out a generic term and coding for butadiene-styrene rubber, alone. A basic classification and coding system for other rubbers determined by chemical composition and polymer chain in the same manner as for "SBR," are being considered by ASTM, the Rubber Division of the American Chemical Society, and the Rubber Manufacturers Association. *Obviously, industry-wide standardization of terminology and coding of the basic raw materials of the industry is more important now than ever before.*

R. G. Seaman

EDITOR

Meetings and Reports

Akron Group's Latest Symposium Devoted to Accelerators; Mueller Dinner Speaker

The most recent of the series of panel discussion-symposium type programs which have been a special effort of the Akron Rubber Group during the recent past was held at the Mayflower Hotel, Akron, O., April 6, and was devoted to the subject of rubber accelerators and curing systems. The evening dinner-meeting was featured by an address by Assistant Secretary of Commerce Frederick H. Mueller, whose subject was "Business Is People." More than 600 members and guests of the Group attended the afternoon technical meeting and the evening dinner-meeting.

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"ACCELERATORS-CURING SYSTEMS" SYMPOSIUM

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By Maurice Morton
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It is entirely appropriate that this symposium on vulcanization accelerators be held here in Akron, which witnessed the discovery and use of the first rubber accelerators, at the turn of the century. The development of these chemicals from that time to their present production, which is measured in thousands of tons, represents one of the most interesting developments in industrial chemistry.

There are somewhere in the neigh hood of a hundred accelerators being duced and marketed in this country to They are not all different, of course, generally fall within the four or five known main categories. A closer inspec of the consumption of these chemicals reveal, however, some very interesting about their use. The statistics shown in following table speak for themselves. It be seen that the thiazoles (and their d fides) account for more than two-third the total consumption of all the accel tors.

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Cyclic compounds		1.703
Zinc dibutyldithiocarbamate		0.766
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Potassium dimethyldithiocarbamate		0.145
Other carbamates		4.084
Tetramethylthiuram disulfide		4.719
Monosulfide		0.747
Other acyclic compounds		4.420
Total		77.172

If we consider the fact that the organic-base types (aldehydeamine and guanidine) are used largely as secondary accelerators to activate the thiazoles, then it appears that the thiazoles indeed dominate the whole field. As a matter of fact, even the "ultra-accelerators" (dithiocarbamates, thiurams, etc.) are largely used as activators to provide a fast initial cure in a thiazole-accelerated compound.

Hence it can really be said that modern rubber vulcanization is based on activated thiazole acceleration. This fact is somewhat surprising, since the thiazoles have been known and used since the mid-Twenties and have apparently grown in use continuously, without being displaced by a superior product. In view of the wide variety of chemical compounds which have been investigated for this application, the only conclusion which can be drawn is that the thiazoles must have the best combination of properties as accelerators, together with the modifications to the vulcanization system which can be introduced by the addition of activators.

An interesting sidelight on the importance of the thiazoles is shown by their history. Thus mercaptobenzothiazole represents one of the few practical discoveries to emanate from a basic scientific investigation! It was the desire of Bedford and Sebrell here in Akron, and Bruni, in Italy, in 1921, to throw some light on the mechanism of acceleration by such early substances as carbanilide and thiocarbanilide which actually led to this discovery. By isolating mercaptobenzothiazole (MBT) as an intermediate in the reaction between thiocarbanilide and sulfur, they were able to prove its remarkable activity. This development is an excellent example of the fact that pure research is not always useless!

From the above remarks it would appear that the use of accelerators is relatively simple, since it is restricted so largely to the thiazoles. Such a situation is not the case at all, as we shall probably realize during the course of this symposium. As today's panelists will point out, it is the effect of the accelerator-curing systems on the properties of the particular products involved which poses the problems. Since rubber goods are made in a variety of forms, from surgeon's gloves to tires, each end-use has its own requirements, and the accelerator must fit in with these requirements. Sometimes these accelerators have rather unexpected effects, especially in their physiological behavior. Thus it is interesting to note that thiuram disulfides have been found to spoil the taste for alcohol. Whether this is a boon or not is obviously debatable, but it is certainly an interesting development.

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History—Theory—Manufacturing

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Since then, many organic compounds have been tried. A little more than 50 are still on the market. Practically all of them fall into five chemical groups: (1) aldehyde amines, (2) guanidines, (3) dithiocarbamates, (4) thiurams, and (5) thiazoles. Of these, the thiazoles are used in by far the greatest volume.

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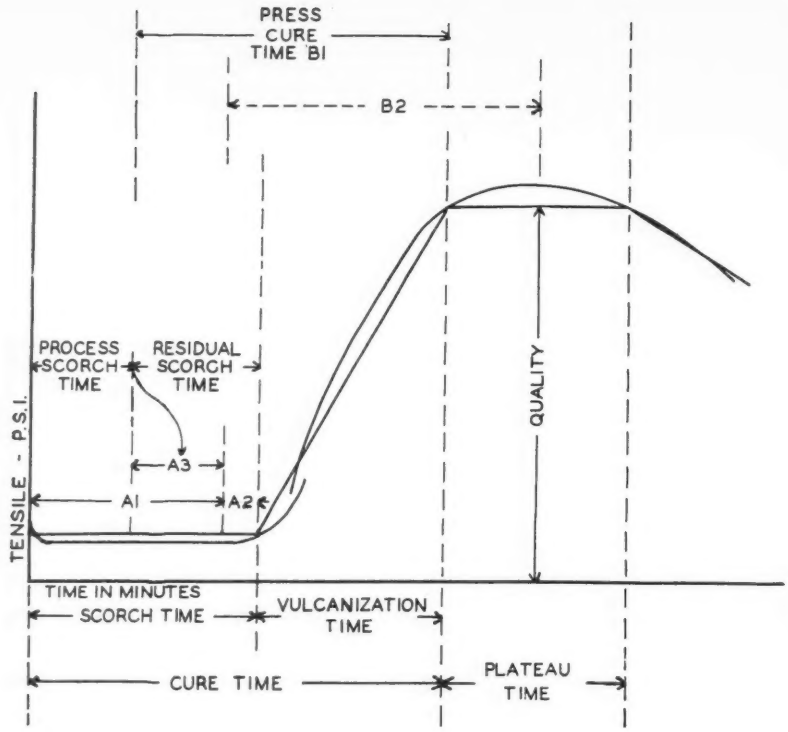


Characteristics of Acceleration for Rubber Compounds—Garvey

corresponding differences in state of cure. The plateau time should be such as to accommodate these differences as well as the heat transfer and aging.

Since the selection of accelerators for use is based on scorch, vulcanization, and plateau times, these are the characteristics which accelerator producers are attempting to furnish in the most desirable combinations. At the same time, of course, we strive to maintain and improve the quality characteristics, the height of the plateau for numerous properties. While each of us here hopes that his company will be the first to come up with a revolutionary type of accelerator or curing system, none of us is really counting on it. Instead, what we really anticipate is a slow continuous improvement in the use of the known accelerators and curing systems, together with similar improvements in the accelerators available. As new elastomers come into the picture, we expect to develop curing systems to meet their requirements.

Tires—Tubes

By A. R. Davis

American Cyanamid Co.

Since about 1943, the accelerator-curing system practice for tires and tubes has been influenced by the following important factors:

1. Availability of synthetic rubber.
2. Availability of reinforcing furnace carbon black since 1947.
3. Rapid production methods for tires and tubes.

The present-day accelerator-curing system choice is predicated on the use of three types of elastomers:

1. Natural rubber.
2. Butadiene-styrene copolymers (GR-S type rubbers).
3. Isobutylene-isoprene copolymers (butyl rubber).

It is, of course, well known that the synthetic rubbers have different curing characteristics than natural rubber. (GR-S type rubber cures slower than natural rubber; while butyl rubber cures slower than GR-S types) so that the accelerator-curing system practice for tires and tubes is now more complicated than that followed prior to World War II. This practice is further complicated by the fact that the reinforcing furnace carbon blacks have a basic pH and activate the accelerator-curing system; while channel carbon black with its acidic pH has a retarding effect.

The increasing use of reinforcing furnace blacks in tire compounds and rapid production methods have required accelerators with more delayed action than those in use prior to 1947, in order to avoid the problems involved with scorching or premature vulcanization of the stocks during processing. These requirements have been responsible for the introduction of several new accelerators in the last five years.

The chemicals discussed below are the most important accelerators now in use for the manufacture of tires and tubes.

1. DIPHENYLGUANIDINE (DPG). DPG is basic in chemical nature and strongly activates the thiazole type of accelerators. In tires DPG is generally used as a secondary accelerator with the thiazoles, particularly in GR-S type rubber stocks.

Example: GR-S-ISAF black tread stock with 2.0% sulfur and 0.9 to 1.25% of a benzothiazole sulfenamide may use 0.2 to 0.4% DPG.

2. MERCAPTOBENZOTHIAZOLE (MBT). MBT is an acidic chemical and is strongly activated by bases. It is very active above 230° F. and has little or no delayed action so that it cannot be used safely in most furnace black stocks. It is sometimes used in channel black stocks alone or with MBTS and is used as a secondary accelerator in butyl rubber tube stocks.

Example: Natural rubber-channel black tread with 3.0% sulfur, 0.5-0.6% MBT plus 0.5-0.6% MBTS for safer processing than straight MBT is typical.

3. BENZOTHIAZYLDISULFIDE (MBTS). MBTS is strongly activated by basic materials. It is very active above 280° F., and although it shows more delayed action than MBT, it cannot be used safely in many reinforcing furnace black stocks. It finds use, however, in some carcass, tread, and natural rubber tube stocks.

Example: Natural rubber-GR-S reclaim type rubber and rubber carcass stock with about 2.75% sulfur, 0.7-0.8% MBTS plus about 0.25% DPG or small amount of a thiuram disulfide is typical.

Natural rubber truck tube stock with 1.0-1.5% sulfur may use 0.8% MBTS, plus 0.2% of a thiuram disulfide.

4. N-CYCLOHEXYLBENZOTHIAZOLE-2-SULFENAMIDE (Santocure[1]). Santocure is a thiazole-type accelerator with good delayed action which is activated by basic materials. It can be used with reinforcing furnace blacks in both natural rubber and GR-S type rubber. In such natural rubber stocks, however, it is often used with N-nitrosodiphenylamine (Vultrol[2] or Retarder-J[3]) a retarding agent.

Example: Natural rubber-ISAF black tread stock with 2.4 to 2.6% sulfur, 0.5 to 0.6% Santocure plus about 0.5% Vultrol is typical.

5. N-OXYDIETHYLENEBENZOTHIAZOLE-2-SULFENAMIDE [NOBS Special[4] and NOBS No. 1[4] (90% NOBS Special + 10% MBTS)].

NOBS Special is a thiazole accelerator with outstanding delayed action which is strongly activated by DPG and other basic materials. In the absence of substantial amounts of furnace blacks NOBS Special may require activation by DPG or by a thiuram monosulfide. The NOBS accelerators are used in natural rubber-furnace black tread stocks and in GR-S type rubber-furnace black tread stocks with or without DPG activiation.

Example: Natural rubber-HAF or SAF black tread stock with about 2.5% of sulfur, about 0.5% NOBS Special is generally used.

6. TETRAMETHYLTHIURAM DISULFIDE (TMTD).

[1]Monsanto Chemical Co., Rubber Service Department.
[2]B. F. Goodrich Chemical Co.
[3]Naugatuck Chemical Division, United States Rubber Co.
[4]American Cyanamid Co., Intermediate & Rubber Chemicals Department.

TMTD is an ultra-accelerator which finds use as the primary accelerator in the slow-curing butyl rubber tube stocks.

Example: Butyl rubber tube stock with 2.0% sulfur and 0.5% MBT, 1.0 to 1.25% TMTD is commonly used.

Note: The percentage of accelerator and sulfur shown above is based on the rubber hydrocarbon.

In addition to the above accelerators there are a few others, such as tetramethylthiuram monosulfide, N-tertiarybutylbenzothiazole-2-sulfenamide, and a few activating materials such as dibutyl ammonium oleate (Barak)[5] and Aktone[6] (a urea complex) which have a somewhat limited use.

With the above accelerators sulfur is used as the vulcanizing agent, and the curing system is generally completed with 3% to 5% zinc oxide plus 1% to 3% stearic acid for activation.

Insoluble sulfur finds some use where blooming on uncured stock is a problem.

For the foreseeable future, it appears that sulfur will continue to be the vulcanizing agent for tires and tubes being made from the present elastomers or to be made from new polymers of similar types. Radically new and different polymers, which may show promise for tires and tubes, may well require new curing systems for their best performance.

In the near future we can expect some new benzothiazolesulfenamide-type accelerators with more delayed action than those now commercially available.

It is believed some improvement in accelerators for camelback will be made, but it is too early to tell what the nature of these new chemicals will be.

Latex—Foams

By R. R. Waterman

R. T. Vanderbilt Co.

The power needed to mix a latex compound is trivial compared to the power required for Banbury or open-mill mixing of dry rubber. Since the power consumption is low, mill scorch does not hamper the latex compounder in choosing a suitable curing system. Consequently, ultra-accelerators are used almost exclusively in latex.

An accelerator suitable for latex use may be a liquid or a powder, soluble or insoluble in water. Upon addition to the stabilized latex, however, it must not cause flocculation or destabilization. Insoluble powders are dispersed and immiscible liquids are emulsified before use. The efficiency of water soluble accelerators should not be impaired by leaching before cure.

Totally precured (prevulcanized) latex can be used for the production of thin-walled dipped articles and fabric coating. There is no counterpart to this in dry rubber.

The end-use of an article generally influences its components. Most latex products are used in a personal way. In other words, latex articles are used either in direct contact or in close proximity to one's person. A few examples are foam pillows and mattresses, gloves, toy balloons, the thread in surgical stockings and girdles, non-woven fabrics for interlining. For uses such as these, the cured article must be non-toxic, odorless (if possible), non-discoloring when in contact with body oils, and light colored for aesthetic reasons.

These many requirements have been satisfied by the compounder using relatively few curing systems.

Following is a list of the curing systems most widely used:

Foam — *Hevea* and *Hevea*-butadiene/styrene rubber blends—when open steam cured at 210° F., contains sulfur 2-2¼ parts; zinc oxide 3-5 parts; accelerator combination 2 parts. Zinc mercaptobenzothiazole and zinc diethyl dithiocarbamate are the accelerators most widely used. The exact amount of each varies, but the total is generally two parts. Frequently a guanidine or aldehyde amine accelerator is present, but its prime function is to act as a secondary gelling agent.

Foam rubber which is to be dry-heat cured will contain an activated dithiocarbamate, sodium salt of a dithiocarbamate, or a partially water soluble dithiocarbamate in addition to the acceleration used for open steam curing.

Foam rubber is almost unique in that to facilitate heat transfer and minimize degradation it is cured before it is dried. The more normal procedure is to dry first and then cure in order to minimize porosity.

Films suitable for toy balloons require a low modulus, long elongation, and considerable transparency. A typical formulation would be zinc oxide 0.25-0.50-part, sulfur 0.75, and a dithiocarbamate or an activated dithiocarbamate.

High modulus films required for certain drug sundry applications would contain zinc oxide 2, sulfur 1, and activated dithiocarbamate 0.25 to 0.50-part.

Neoprene meteorological balloons will contain zinc oxide 5 parts, sulfur 1, and an accelerator system containing one or more of the following—thiuram, guanidine, dithiocarbamate, activated dithiocarbamate.

Neoprene rug backing compound will contain up to 25 parts of zinc oxide. The main reason for this amount is to have the zinc oxide act as an acid acceptor and insure long life to the rug fibers. The balance of the curing system would be essentially the same as for the meteorological balloons.

Hevea-GR-S type rubber blends used for rug backing will have zinc oxide 5, sulfur 1 to 2, zinc mercaptobenzothiazole and activated dithiocarbamate.

In GR-S type rubber the thiazoles produce longer elongations than the dithiocarbamates. The thiazoles, however, require high curing temperatures (260° F.).

Nitrile latices are cured using a thiazole-dithiocarbamate combination, a zinc oxide content of 1-3 parts, and sulfur at 1-2 parts.

The carboxylic nitriles will develop high tensiles using zinc oxide as the sole vulcanizing agent. The use of a thiazole-dithiocarbamate in conjunction will improve the cured properties.

To summarize: Latex cures are effected at lower temperatures and with lower amounts of sulfur and activator than dry rubber. This more efficient use of curatives is due to more thorough dispersion and absence of degradation during mixing.

The outlook for the future in latex compounds is a triggered curing system suitable for the 2,000 feet per minute of the paper industry; then non-woven fabrics could be made on paper machines. Also, a curing system that would quadruple present tear strength of latex films; and a curing system that would permit filler reinforcement.

Extruded Mechanicals—CV Wire and Cable

By A. M. Neal

E. I. du Pont de Nemours & Co., Inc.

A common characteristic of both extruded mechanical goods and wire and cable is that no deformation or distortion of the finished product can be tolerated during the vulcanization step. This requirement places a severe limitation on the accelerator and curing system employed. The two most important considerations are processing safety and the requirement for a fast set-up.

Although processing safety is always an important criterion of practicability, it becomes of even greater importance in these extruded items because the extrusion process that they all must undergo as the final step in their preparation presents an additional source of "heat history" and greatly increases the chances for scorch. Furthermore, since close tolerances in the final product are normally required for these products, even the smallest amount of scorch taking place during the extrusion step is almost sure to result in unsatisfactory finished goods.

The requirement for fast set-up is caused by the fact that since the final product is usually not supported during the curing step, it is necessary that vulcanization start before plastic flow due to heat takes place. Referring to Dr. Garvey's chart, this can be expressed by the fact that for this class of compounds the area, A-2, must be as small as possible, and generally speaking the slope of the curve during the vulcanization time should be as steep as possible. Failure to fulfill this requirement will completely offset all of the careful work which has been done to insure that the unvulcanized extruded part has met all of the specifications of the final product.

Both laboratory studies and factory experience have shown that with either GR-S type or natural rubber the requirements just discussed are best fulfilled when a thiazole is used as the primary accelerator, and if activation is required, as it usually

[5]E. I. du Pont de Nemours & Co., Inc., Elastomers Division.
[6]J. M. Huber Corp.

is, the activator is selected from the class of the thiuram accelerators. Except where special properties, including heat resistance, are of major consideration, the sulfur level is conventional, usually being in the range of 1.5 to 2.5 parts. When neoprene is employed for this type of product, it is almost always necessary to use an accelerator, and experience has indicated that Permalux[5] and NA-22[5] are the best candidates.

The effects to be expected when a thiazole is activated with a thiuram can best be understood if one considers a specific case, i.e., a GR-S type stock containing 2.5 parts of sulfur and 1.5 parts of MBTS. If a thiuram monosulfide is added to this stock, the following effects will be found. First, scorch time will be decreased although not so drastically as when a basic accelerator such as a guanidine or an aldehydeamine is employed as the activator. Second, the rate of cure will be increased, or considered from the standpoint of the problem set forth in this discussion, the time between the beginning of vulcanization and the development of maximum properties of the vulcanizate will be markedly decreased. Third, the modulus of the stock will be increased. Fourth, the plateau effect so important from quality considerations will not be markedly reduced.

In most cases the amount of thiuram monosulfide used will vary from 0.05- to 0.5-part. If the thiuram content is increased, over this range, the effect on rate of cure and modulus increase will be about proportional to the amount of thiuram used. Most of the effect on scorch rate will be observed with the first increments of thiuram monosulfide, and above approximately 0.1-part the effect will be small. In order to maintain the good plateau effect it will frequently be necessary to adjust the sulfur content downward when higher levels of the thiuram are employed.

Three methods of curing these articles are worthy of some discussion. The first, or oldest method, will be called the conventional method. The second, applicable primarily to wire and cable, is popularly called the CV (continuous vulcanization) method of curing; and the third, and newest of them, is frequently called dielectric curing.

In the conventional method the articles are usually cured in open steam at temperatures ranging up to approximately 300° F. The time of cure will, of course, be dependent upon the temperature and the thickness of the article. In general, the times will range from 30 to 90 minutes. A typical acceleration for GR-S type compounds cured by this method would be: Sulfur 2.5, Zenite[5] 1.5, Thionex[5] 0.1. A typical Neoprene Type GN stock would contain 0.35-part of NA-22.[5]

CV curing has been applied primarily to wire and cable stocks. In this method the wire is cured at temperatures of approximately 400° F.., and the curing time is measured in seconds, normally from 15 to 60 seconds. The great commercial success of this type of curing in the wire industry has been closely associated with the ability to run stocks which are very highly accelerated. A typical acceleration for a GR-S type wire insulation stock would be: sulfur 2.5, Zenite 3.0, Thionex 1.5. Note particularly the high level of both primary accelerator and activator in this formulation. Neoprene jacket stocks which can be run equally successfully in a CV cure should contain one part of NA-22.

In dielectric curing the heating is brought about by means of radio frequency waves, usually those ranging from 8 to 27 megacycles per second. The successful use of this method depends upon the dielectric properties of the elastomeric compound being cured. It has found its greatest application to date in the drying and curing of latex foam articles. It has been applied with considerable success, however, to many extruded items. It has not been adapted successfully to wire as yet owing to the problems arising from the presence of the conductor in the wire. Mere size places no limitation on the type of product which can be successfully cured by this method since the heat is generated uniformly throughout the article. Cure times approximate those encountered in CV curing; a normal factory cure is of the order of one minute.

Very fast acceleration is required in order to prevent the development of porosity, and this requirement means that the unvulcanized article has a very short storage stability, and the stocks may be extremely difficult to process in the factory. Accelerations of the type previously discussed are generally not fast enough for this type of curing. Satisfactory results have been obtained by substituting MBT for the MBTS or other derivative normally used as the primary accelerator and a metal or ammonium salt of a dithiocarbamate for the thiuram sulfide as the activator.

Molded Mechanicals—Belting—Footwear

By D. E. Baker
Monsanto Chemical Co.

You have heard the previous panelists give an accounting of what can be used in the way of acceleration for the products that they have been assigned.

The category "mechanicals" in rubber covers a vastly larger field than any of the other categories discussed here today. Usually we consider mechanical rubber as being divided into two classes: namely, molded and extruded. This paper will deal only with the molded class; however, many molded mechanicals are first extruded to afford both economcal handling and rough preforming for molding.

Molded mechanicals may be further divided mainly into the following groups: 1) stocks for general-purpose use; 2) stocks for government and Armed Forces and other specification use; 3) stocks for specialties and drug sundries; 4) stocks for automotive use.

When we consider such a grouping, it can readily be seen that the classification "molded mechanicals" will and does require all the curing systems of the other categories plus other curing systems that may be necessary, depending upon the end-use of the product.

The first group, "stocks for general-purpose use," as the name implies, does not have very many specific requirements. Usually the hardness of the finished product is perhaps the most important, and beyond that about the only requirement is that the stock does not disintegrate during service.

Compounds of this type are usually accelerated with the most economical types of accelerator. Of course, this practice will depend upon the basic polymer used in the compound. When the basic polymer is natural rubber either new or reclaimed, you may use one of the guanidines, mercaptobenzothiozoles, or thiurams. A combination of any two of these-type accelerators can also be used to advantage in many cases.

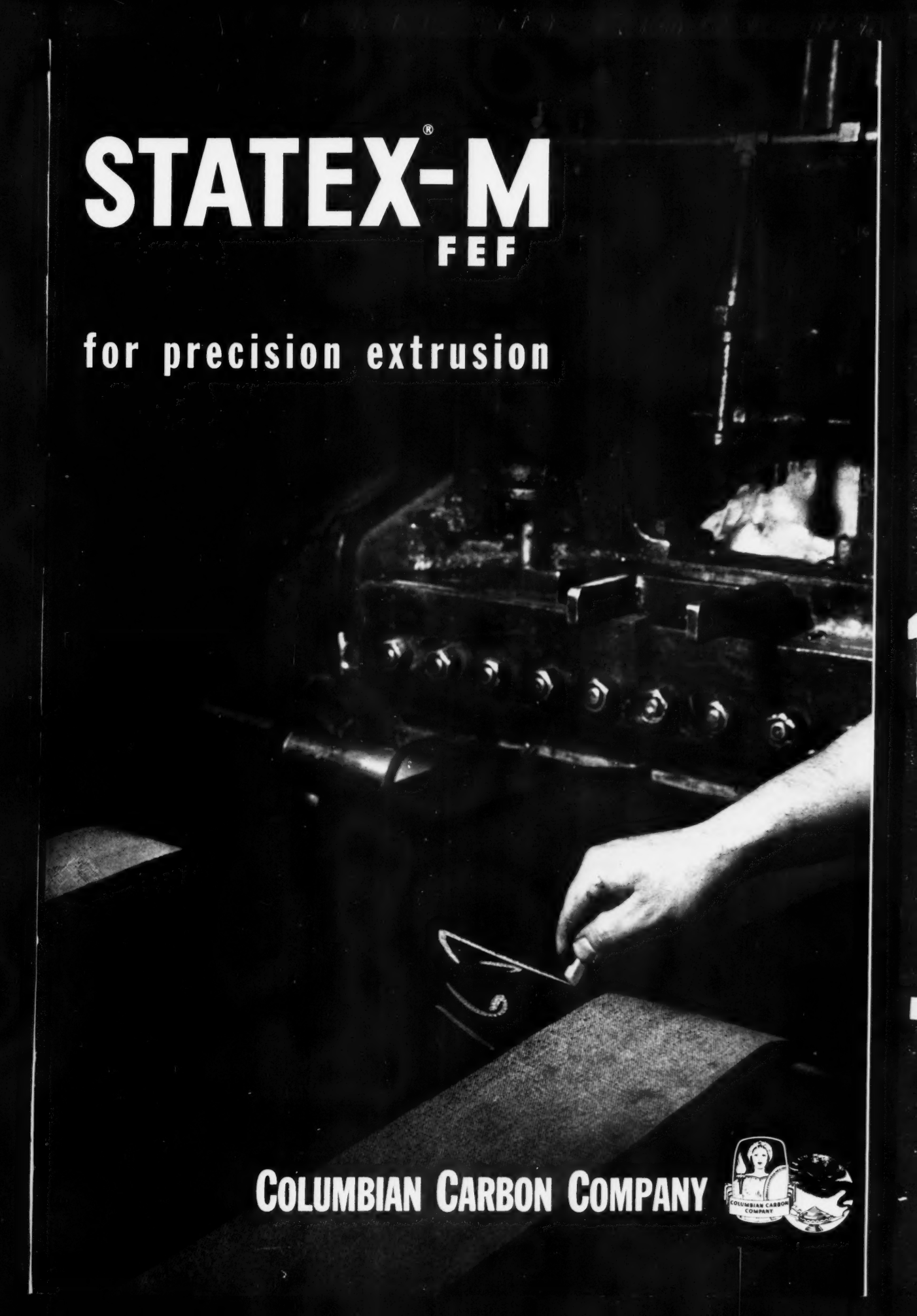
If the basic polymer is GR-S type rubber, then the guanidines are almost sure to be the secondary accelerator since the mercaptobenzothiazole type or thiuram type of accelerator is more efficient in GR-S type rubber. Here again the combination type of acceleration plays a very important role in the vulcanization of GR-S type stocks, and we may find combinations of two or three different types of accelerators.

The second group "stocks for government and Armed Forces and other specification use," is usually of somewhat higher quality than the first group and in many cases is of the highest quality. This second group will in many cases require accelerating systems to provide maximum heat resistance and compression set as well as aging and flex life.

If an extremely good heat resistance is required, it will be advantageous to use a very low elemental sulfur ratio and tetramethylthiuram disulfide, or no elemental sulfur but a higher dosage of tetramethylthiuram disulfide. Many compounders think that a combination of tetramethylthiuram disulfide and N-cyclohexyl-2-benzothiazole sulfenamide give superior heat resistance and aging to that obtained with the use of only the thiuram. Excellent compression set data can also be obtained with any of these curing systems. It is almost universally true that a compound that is accelerated with tetramethylthiuram disulfide in excess of about 0.75% will bloom.

If extremely good heat resistance is not a prime requisite then one of the mercaptobenzothiazole-type accelerators may be used along with elemental sulfur. In many cases a secondary accelerator or kicker is used with the MBT-type accelerator to provide a better cure and physical properties to a compound than would be obtained without the secondary accelerator. For instance, a small amount of one of the thiurams with any of the MBT-type accelerators will give a definite improvement in compression set over that obtained with only the MBT-type accelerator.

The carbamates can also be used as secondary accelerators with the MBT-type accelerators with approximately the same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results. The ratio of MBT-type accelerator to thiuram or carbamate is usually within the limits of 9 to 1 or 8 to 2; in some instances, however, ratios outside these limits may be desirable. These accelerations are applicable to natural, GR-S and nitrile type rubbers. Combinations of an MBT-type accelerator and a guanidine may be used, and the ratio of MBT to guanidine will vary over a rather large range, depending upon the polymer, compounding ingredients, and MBT-type accelerator used.

The third group, "stocks for specialties and drug sundries," cover a group of compounds that would not normally be included in the other groups given here. This group consists of compounds that are primarily white or colored and, as such, must use accelerator systems that are capable of producing non-discoloring vulcanizates. There is also the problem of odor and taste in some of these compounds as well as toxicity. The better accelerators for color stocks are the MBT, thiuram, and carbamate types.

The problem of odor and taste is an important one in some types of stock, depending upon their end-use. The basic compound must be such that there is a minimum of odor and/or taste, and then the acceleration system has to be one that will provide the most freedom from odor and/or taste. Actually, there is no such thing as an odorless and tasteless piece of rubber. This statement is made simply because if a test is conducted among a sufficient number of people, a certain number will definitely object to either or both odor and taste. Rubber may be reodorized by the use of one of the many reodorants available, but there is no method of completely deodorizing cured rubber.

The guanidines, such as DPG and DOTG, are fairly good from an odor standpoint, but both tend to produce a bitter taste. Tetramethylthiuram monosulfide usually imparts a slightly sweet taste and odor to a vulcanizate. Tetramethylthiuram disulfide and the carbamates tend to give an odor in most cases and usually impart some taste. Mercaptobenzothiazole may prove fairly good for odor and taste in some cases and not in others.

It remains true that each individual compound has to be tested with the different accelerators mentioned if a reasonably good performance is to be attained as to odor and taste.

Toxicity is important in many types of drug sundry stocks, and care must be taken in such stocks to use an accelerator or accelerators that do not cause dermatitis or have other ill effects, depending upon the use of the stock. Actually there are no present-day curing systems that are not toxic to some extent under certain conditions, and, furthermore, a certain percentage of people always is allergic to things not commonly known as toxic.

The fourth group "stocks for automotive use," covers compounds for a large number of uses and conditions. The accelerators used in this group include all those that would normally be used in the previous groups. In addition to providing good aging, compression set, and other physicals, many of these compounds must not stain finishes either in contact or by migration. This problem is further complicated by the fact that what will stain one type of finish may not stain another and *vice versa*. It is usually true, however, that one of the MBT thiuram, or carbamate type of accelerators will be found fairly satisfactory, but it is almost impossible to tell whether they are suitable without an actual test on the finish in question.

Belting compounds present problems that may approach those of the tire compounder, or they may be similar to other high-quality molded goods. Therefore the accelerator and curing system will follow along the lines of these types of compounds.

Footwear compounds are usualy fairly uniform in their acceleration requirements. MBTS is probably the largest single accelerator used, which in turn is combined with either a guanidine such as DPG or DOTG or one of the thiurams of carbamates. These combinations pretty well cover the accelerator requirements for dry-heat curing of rubber footwear. A rather standard accelerator ratio for natural rubber is 60/40 MBTS-guanidine or 90/10 MBTS-thiuram or carbamate when dry-heat cures are desired.

Question and Answers

Q. What curing system is best to keep the cold flow of Neoprene Type GN-A to a minimum? What effect do curing systems have on cold flow of other polymers?

A. Neal. The best information seems to indicate that cold flow is more a property of the state of cure of the elastomer than it is of how the state of cure is obtained. Cold flow can always be minimized by obtaining a very full cure in the product under consideration, and this seems true regardless of the type of elastomer. For Neoprene Type GN-A stocks this property can be obtained through the use of an accelerator such as Permalux or NA-22.

It is extremely important with neoprene stocks designed for resistance to cold flow to avoid the use of a retarder such as MBTS. For GR-S type or natural rubber the best resistance to cold flow is obtained through the use of a thiuram type of acceleration. An alternative curing system which will give excellent results is a thiazole activated with a thiuram.

Cold-flow properties are sometimes confused with changes due to crystallization. If crystallization is a factor, best results can be obtained in a neoprene stock by substituting Neoprene Type GRT or WRT for the GN-A.

Q. What are the advantages and disadvantages of liquid accelerators for latex foam and film compounding? What about the future of same?

A. Waterman. Liquid accelerators used in latex are two types, (a) self emulsifying, (b) water soluble.

Universal advantages are that these liquid accelerators are ready to use, easy to add, easy to store, easy to dispense, and do not settle out of a compound. Disadvantages are that with foam rubber they may upset gelation system (especially the water soluble types).

In foam rubber which is washed before cure is complete, some of the accelerator may be removed during the washing (especially the water soluble type of accelerator). These liquid accelerators may be removed from very thin films which are leached before cure. The water soluble type may be more troublesome than the self-emulsifying type in this respect.

The future increased use of synthetic rubber latices with controlled particle size indicates increased use of liquid accelerators.

A. Davis. A number of liquid accelerators are water soluble or are water solutions of alkali metal salts of dithiocarbamic acids. These are ultra-accelerators and are too fast for general dry rubber compounding. These water soluble accelerators tend to increase the water absorption of the vulcanizate and have an adverse effect on the electrical properties of the cured rubber. Most other available liquid accelerators are aldehyde amines, which in general are effective high-temperature accelerators offering a wide range of curing and scorch rates. They generally give good aging vulcanizates, but show varying degrees of discoloration so that some of them cannot be used in the best white rubber stocks.

There is generally some loss of accelerator in handling liquid accelerators to which some compounders have objections.

During the 1920's and early 1930's a number of liquid aldehydeamine accelerators were used fairly extensively, but at present there appears to be no very extensive use of these accelerators. For the foreseeable future no outstanding growth in the use of these liquid accelerators in dry rubber compounding appears likely.

A. Garvey. The advantage of a liquid accelerator is in the ease and completeness of dispersion. This, of course, presupposes that the liquid is soluble in the rubber and preferably miscible with it. In this case an excellent dispersion is easily obtained, and the liquid will diffuse on standing to give a homogenous mixture with the rubber. Another advantage might be when liquid accelerators are used in automatic feed to a Banbury mixer by means of a proportioning pump.

The disadvantages are on compounding and milling. It is a little more difficult to weigh and handle a liquid than it is a solid and to clean out the container. On an open mill a liquid is a little more difficult to incorporate than a powder unless the liquid is added with a pigment. This difficulty would not apply when the liquid is used in Banbury mixing.

Both the advantages and disadvantages inherent in the liquid state are relatively minor, and it is doubtful if they would be decisive except where other factors are nearly equal.

Q. What is the effect of type and amount of accelerator on tread cracking of truck tires?

A. Baker. The cracking that may be experienced in truck treads can be influenced by the type and the amount of accelerator used. Today it is a generally ac-

cepted fact, however, that the basic acceleration for truck treads is a thiazole type. In some few cases there may be a secondary accelerator used, but this will be in a low ratio to the primary accelerator.

The thiazole-type accelerator is one that usually gives good flex life to a compound. Some other types of accelerators, such as aldehydeamines and guanidines, are not so good as the thiazole type, but they are not used to any extent in truck tires.

The amount of accelerator used does have a bearing on the flex life of a compound. If the accelerator ratio is too high in a compound, it may be that an overcure will be obtained, and this fact coupled with the persistency of the accelerator will cause excessive cracking. In some instances, too low an acceleration ratio will also promote cracking. A well-balanced cure is usually best for flex life.

A. Garvey. Tread cracking must be balanced against tread wear and especially against heat build-up. This balance seems to be a question of state and type of cure. The significance of type of cure is a little vague, but it seems to depend somewhat on the type of accelerator and the amount of sulfur. The state of cure is more definite. A high state of cure, or a tight cure, generally means low set and low heat build-up. It is usually accompanied by poor tear and poor crack resistance. A low state of cure generally means high set and high heat build-up and is accompanied by good tear and good crack resistance.

Present indications are that the best balance for truck tire treads is obtained with thiazole-type acceleration and sulfur levels between 2.25 and 3.0 PHR, usually between 2.5 and 2.75 PHR. The type and the amount of thiazole acceleraton must be adjusted to give a good cure with this amount of sulfur, with scorch time and cure time adjusted to factory requirements.

A. Davis. Assuming that the other factors besides the accelerator-curing system involved in truck tire tread cracking have been eliminated, then for the best resistance to cracking the right type of accelerator and proper amount of sulfur must be used. Natural rubber is generally used for truck treads. Over the years the thiazoles (MBT, MBTS, etc.) have given about the best results. In channel black tread stocks close to 2.9-3.0% of sulfur with sufficient accelerator (about 1.0%) to give the optimum cure has given the best results. Undercures and overcures seem to crack earlier than optimum cures.

In the case of truck tread stock with the usual channel black-furnace black mixture, 2.75-2.9% sulfur with 0.75-1.0% MBTS appears to give good results. In the case of truck tread stocks with furnace black it seems desirable to keep the sulfur ratio close to 2.5% with about 0.5% of a good delayed-action accelerator of the benzothiazole-2-sulfenamide type for safe processing.

Q. Is dicumyl peroxide-type cure system being used commercially? What advantages or disadvantages has this type of cure shown in tires and industrial products?

A. Neal. The use of the dicumyl peroxide curing system probably cannot yet be classified as being used commercially. It has, however, already been employed on a semi-commercial scale. In view of the short time that this product has been available such progress is indicative of real merit. The chief advantages of this method of curing are complete lack of color imparted by the system, the closely related abilty to produce stocks which are nonstaining, and the fact that it is possible to produce vulcanizates having outstanding resistance to compression set and excellent low-temperature properties. The chief disadvantages are the inability to cure in the presence of large volumes of air and the lack of auxiliary agents which will either accelerate or retard the curing action.

Q. What accelerator combination for latex foam produces the shortest cure in steam at atmospheric pressure?

A. Waterman. The following acceleration is recommended for 100% to 70% *Hevea*-30% GR-S type rubber blends:

	PHR
Zinc oxide	5
Sulfur	2-2.25
Zinc salt of mercaptobenzothiozole	1-1.5
Zinc diethyldithiocarbamate	1
Aldehydeamine	1
or	or
Guanidine	0.75
Activated dithiocarbamate	0.5
or	
Water soluble dithiocarbamate	0.5

Q. What explanation as to structure of vulcanizates can be given to explain the better heat aging properties of a non-elemental sulfur cured stock compared with a conventional sulfur cure?

A. Garvey. First, we will confine ourselves to a conventional sulfur cured vulcanizate and a heat resistant one cured with thiuram disulfide.

Currently accepted theory is that vulcanization is caused by cross-links established between the fiber molecules of the unvulcanized rubber. Molecularly speaking, the vulcanizate is a tangled mass of fibers in which crossing fibers are periodically welded together by chemical reaction. These chemical cross-bonds by locking in some of the mechanical entanglements also establish a certain number of mechanical cross-bonds. A physical analogy would be a mass of steel wool in which the individual steel fibers were spot welded at various places.

Originally, both the sulfur cured and the thiuram cured vulcanizates have structures similar to that mentioned in the preceding paragraph. On heat aging, however, the thiuram cure retains this structure much better than the straight sulfur cure. It has a more stable structure.

We know that heat aging involves destructive action due both to heat itself and to oxidation.

It is fairly well established that cross-bonds of different chemical types are formed in different kinds of vulcanizates or even in different amounts in the same vulcanizate. Some such bonds are more resistant to heat aging than others. One explanation, then, is that more stable bonds, say monosulfide or carbon to carbon bonds, are formed in thiuram cures while less stable bonds, say disulfide bonds, are formed in conventional sulfur cures. I feel confident that such differences, and possibly these exact differences, in chemical type of cross-bond are a major factor in the superior heat resistance of thiuram cures.

However, since the degrading action of heat and oxygen undoubtedly affects the fiber as well as the cross-bond, there is probably a constant degrading action going on, as shown by the reversion of a natural rubber compound. Stability of structure then requires a corresponding building or vulcanizing action of about the same rate Hence, I still like the idea I expressed some years ago that in heat resistant stocks there is a dynamic equilibrium which maintains a fairly uniform molecular structure in the vulcanizate. The breakdown due to heat and oxygen is almost balanced by the build-up caused by the continuing vulcanization reaction of the thiuram or its decomposition product. In the conventional sulfur cure this continuing vulcanization reaction is either much less than in the thiuram cure, or it is absent.

There is one other factor. The relatively large amount of thiuram, and again I must say or its degradation products, must act as an antioxidant both for the degrading and the cross-linking actions of oxygen. In natural rubber where the degrading action predominates, the antioxidant action is not readily distinguishable from the continuing vulcanizing action. However, in the styrene and nitrile rubbers where oxidation causes increasing modulus, hardness, and embrittlement, increased vulcanizing action should accentuate the hardening. Here, however, the heat resistant stocks harden less than sulfur cured ones. Hence I conclude that in thiuram cures the cross-linking or vulcanizing action of oxygen is inhibited.

In brief, my answer is that, compared to conventional sulfur cures, the thiuram cures give cross-bonds of a more stable chemical type; they exert a continuing vulcanizing or cross-linking action of oxygen.

Q. What is the function of zinc oxide and stearic acid in curing systems? Are either or both necessary?

A. Waterman. Zinc oxide functions as an activator in *Hevea,* nitrile, and GR-S type rubber latices. It is used as a vulcanizing agent in neoprene and carboxylic nitrile latices.

Stearic acid as such is not used in latex compounding. Both natural and synthetic rubber latices contain fatty acid or other emulsifiers. These emulsifiers accomplish the function of stearic acid in milled rubber.

The presence of a zinc bearing material is necessary for cure. Zinc oxide normally serves this purpose. However, various other zinc bearing materials can be used.

A. Garvey. Practically all the current accelerators require zinc oxide to be most effective and to impart the best quality to the compound in which they are used. The zinc oxide in turn is most effective in the presence of stearic acid or some equivalent fatty acid. Apparently a nascent zinc salt is most effective, and this is obtained by the reaction of stearic acid, zinc oxide, and accelerator *in situ.* Absorption of small amounts of H_2S by the nascent zinc soap is probably a factor also.

For best results both zinc oxide and stearic or other fatty acid are necessary. The fatty acid may be present in sufficient amount in the crude natural rubber and hence may not need to be added separately. However, since a little excess fatty acid, up to the point of bloom, is not usually harmful, it is considered safest to add stearic acid when there is doubt as to the amount present.

Q. What is the lowest practical sulfur content for the following tire compounds: (1) Cold GR-S type rubber, oil masterbatch GR-S type, and crude natural rubber tread compounds with HAF and ISAF black loading for passenger and truck tires? (2) Truck tire body stocks?

A. Baker. The data obtained in laboratory tests using low sulfur content treads may be a little misleading since actual road tests do not always give the expected service for a compound.

In the case of GR-S type cold rubber and HAF black, about 1.6% sulfur on the rubber seems a practical low limit.

In the case of oil-extended GR-S type rubber, if we consider only the rubber content, then oil-extended rubber will require a higher sulfur than non-oil extended if a satisfactory cure is obtained. The oil content of the polymer will require some sulfur, and the higher the oil content the more sulfur is required.

Passenger natural rubber HAF treads may go as low as 2.0% sulfur, but usually the sulfur content is nearer 2.25 to 2.5%. Truck natural rubber HAF treads may have sulfur ratios as low as 2.25%, but in most instances the ratio will be nearer 2.4 to 2.7%. In general, low sulfur ratios tend to produce poorer abrasion and in some cases poorer flex life than the normal sulfur ratio. There is little if any difference in the amount of sulfur required with HAF or ISAF blacks.

Truck tire body stocks are made mainly of natural rubber and require sulfur ratios of from 2.25 to 2.75%, depending upon the stock. If the sulfur ratio is too low, there is the problem of high heat generation which is very detrimental. A rather general sulfur ratio would be 2.6 to 2.75%.

A. Davis. (1) For cold GR-S rubber-furnace black tread stocks, 1.6-1.75% sulfur seems to be about the lowest practical sulfur content.

For GR-S rubber oil masterbatch this figure seems to be about 2.0% on the rubber hydrocarbon.

For natural rubber treads with furnace blacks the lowest practical sulfur content appears to be 2.4 to 2.6% on the rubber.

(2) For truck tire body stocks the lowest practical sulfur content appears to be close to 2.6 to 2.8% on the rubber.

Q. What curing systems are recommended for best heat resistance in the common elastomers?

A. Neal. The heat resistance of any elastomeric product is dependent upon the base elastomer used and the type of curing system employed. No attempt will be made to try to compare the heat resistance of the various elastomers, but only to indicate which curing system gives the best heat resistance for the specific elastomer.

With natural rubber and the butadiene acrylonitrile polymers the best heat resistance will be obtained through using a high thiuram disulfide, no sulfur stock. An alternative method to get good heat resistance will be a low sulfur, high thiazole stock. Only slightly inferior heat resistance will be obtained by activating the low sulfur, high thiazole stock with a thiuram.

With GR-S type rubber the best heat resistance will be obtained by using a low sulfur, high thiazole stock which will probably have to be activated with a thiuram in order to have a practical rate of cure.

With neoprene stocks the best heat resistance will be obtained through the use of high amounts of zinc oxide coupled with NA-22 as the accelerator.

In general, Neoprene Type W stocks will give slightly better heat resistance than Neoprene Type GN stocks. The addition of nickel dibutyl dithiocarbamate (NBC) to this stock will further increase the heat resistance.

With "Hypalon"[7] stocks the best heat resistance is obtained by using a mixture of magnesia and litharge as the curing agent instead of either of them individually. NBC will also assist these stocks.

With butyl rubber the best heat resistance is obtained by employing quinone dioxime or its dibenzo derivative in conjunction with litharge.

In all cases stocks designed for heat resistance should contain an adequate quantity of a good heat resisting antioxidant, although, generally speaking, the proper selection of the curing system will be more important than the proper selection of antioxidant.

A. Baker. Maximum heat resistance can usually be obtained in the common elastomers by the use of 3% to 4% of the tetramethylthiuram disulfide and 3% of Santocure. Other combinations give very good heat resistance without the use of a high thiuram content. For instance, about 1.5% of tetramethylthiuram disulfide and 1.5% of Sulfasan R[1] will give heat aging about equal to that obtained with 3% or 4% of tetramethylthiuram disulfide along in most cases.

A. Davis. For natural rubber a sulfurless cure with about 3% to 3.5% tetramethylthiuram disulfide with 0.5% Telloy[8] is generally recommended. In the case of nitrile rubber, 0.2% sulfur with 3.0% tetramethylthiuram disulfide plus 3% MBTS is recommended.

For GR-S rubber about 3.5% tetramethylthiuram disulfide plus about 1.0% MBTS is commonly recommended.

In the case of butyl rubber the best heat resistance is obtained with Enjay Butyl 325 containing about 25 parts of zinc oxide using the quinoid-cure system.

Example: sulfur 2%; p-quinone dioxime 2%; MBTS 4%; lead peroxide 5%.

Q. What is the best curing system to minimize water swell of neoprene and GR-S type rubber latex compounds? Is there a relation between water swell and chemical resistance?

A. Waterman. In latex film, water swell is a measure of wetting and reemulsification. A tight cure and the absence of hydrophilic materials in the finished article will minimize water swell.

For low water swell in neoprene latex:

	PHR
Clay (low water swelling)—	20
Zinc oxide	5
Sulfur	1
Zinc dibutyldithiocarbamate	1
Activated dithiocarbamate	

For low water swell in GR-S-type latex:

	PHR
Zinc oxide	5
Sulfur	2
Activated dithiocarbamate	2-3

There is no clear-cut relation between water swell and chemical resistance.

A. Garvey. The curing system as such has relatively little influence on water swell. A tight cure helps some to reduce water swell, but it is a minor factor.

Water swell in hydrocarbon rubbers is largely an osmotic effect. Water soluble materials and hydrophylic materials in the compound induce water absorption. Thus water soluble materials such as salts, free acids, etc. should be eliminated as completely as possible. Rubbers which themselves contain hydrophylic groups swell more in water than the hydrocarbon polymers. There is apparently no direct relation between water swell and chemical resistance. Water soluble chemicals may penetrate further and react faster if the rubber is swollen by water. On the other hand, chemicals dissolved in water tend to reduce the swelling of the rubber in the water, again apparently an osmotic effect.

A. Neal. The maximum water resistance for both neoprene and GR-S type rubber compounds will be obtained on vulcanizates which have a very full state of cure. With neoprene compounds it is important to use a litharge type of cure rather than the magnesia-zinc oxide cure conventionally used with neoprene compounds. With GR-S type stocks it appears that the choice of the filler loading will be far more important than the choice of the curing system.

If chemical resistance is restricted to the attack by aqueous solutions of chemicals, it is obvious that there is a direct relation between water swell and chemical resistance. In its broader aspect, however, chemical resistance involves attack by non-water soluble chemicals, i.e., hydrocarbons and organic esters. In this case there is no direct relation between water swell and chemical resistance, although, in general, the best chemical resistance, like the best water resistance, will be obtained in a product which has the highest state of cure.

Q. What accelerator-curing system is recommended for (a) fast-curing high modulus butyl rubber vulcanizates? (b) Blends of halogenated butyl rubber and natural rubber compounds?

A. Davis. (a) The quinone dioxime curing system is recommended for fast curing, high modulus butyl rubber vulcanizates. *Example:* 6 parts of Dibenzo GMF plus 10 parts red lead.

(b) Published data indicate that in a blend of brominated butyl rubber and

[7] Chlorosulfonated polyethylene, Du Pont Elastomers Division.
[8] R. T. Vanderbilt Co.

natural rubber with HAF black, 2% of sulfur with 1% MBTS gives good results. If desired, a little DOTG may be used with the MBTS.[9]

A. Garvey (a) Probably the fastest curing, highest modulus butyl rubber compounds are those with quinone dioxime, GMF (2.0 PHR), and red lead or litharge (4.0-8.0 PHR). Next will come sulfur cures with 1-2 PHR sulfur, 1-2 PHR of a thiuram disulfide, and 0.25- to 0.5-PHR of Polyac[5] (dinitroso-benzene). Both of these types are scorchy, however, and cause bad discoloration and staining. If staining is objectionable, it is necessary to go to the usual sulfur thiuram type of cure with 2.0 PHR of sulfur and 1-3 PHR of tetramethylthiuram disulfide. Some increase in cure rate and modulus is obtained by replacing half the thiuram with either selenium or tellurium dithiocarbamate.

(b) The makers of halogenated butyl rubber recommend essentially the same curing system used with GR-S type rubber:

	PHR		PHR
Sulfur	2.0		2.0
MBT	0.5	or	1.0
TMTDS	0.5	or	0.25

Q. Under what conditions will carbon-disulfide cure rubber? Are amine type activators and sulfur necessary? What is a good reference?

A. Davis. About 1920, Bruni found cold vulcanization of rubber containing zinc oxide, sulfur, and an aromatic amine could be obtained by exposure to carbon disulfide vapors. The zinc oxide, sulfur, and amine appear necessary. There is a reference to this work in "Science of Rubber"—Memmler, American Edition by Dunbrook and Morris, Rheinhold Publishing, New York.

Q. What curing systems produce maximum flex life in the common elastomers?

A. Neal. With natural rubber, maximum flex life is obtained by using a thiazole as the accelerator. Although it has not been fully established the predominance of evidence seems to indicate that slightly improved flex resistance is obtained with a high state of cure. With GR-S type rubber compounds the flexing problem becomes one of cut growth rather than the inception of cracks. The evidence seems to show that an overcured condition leads to extremely poor cut-growth resistance. This factor seems far more important than the choice of accelerators used.

From a practical standpoint the problem has been solved best by keeping the sulfur content low as a means of preventing overcure and using a thiazole or an activated thiazole for the accelerator. Neoprene stocks are so flex resistant that types of curing systems have very little effect. There is some indication that high states of cure do have a moderately adverse effect.

A. Baker. The thiazole-type accelerators usually provide good flex life in a compound. Thiurams also are good in some compounds as are certain combinations of thiazoles and thiurams. As a class, however, the thiazoles are considered capable of producing good flex life in most of the present-day elastomers.

Q. What curing systems are recommended for neoprene, GR-S type, nitrile and natural rubber compounds at temperatures under 140° F?

A. Waterman. For natural rubber latex compounds use zinc oxide, 5; sulfur, 1; and activated dithiocarbamate, 2 to 3 PHR.

Neoprene, GR-S type and nitrile rubber latices require temperatures in excess of 140° F. for vulcanization.

A. Garvey. The fastest curing accelerators for all of these except neoprene are the zinc or amine salts of dithiocarbamates. These may be used in conjunction with MBT or its zinc salt. From 1-3 PHR of sulfur with 1-2 PHR of zinc dimethyl dithiocarbamate, or diethyl ammonium diethyl dithiocarbamate or Pip-Pip[1] are good systems. They can sometimes be activated by excess amine, say 1-3 PHR. The addition of 1-2 PHR of MBT or Zn MBT will improve aging some and may give a slight kick to the cure.

For neoprene, aldehydeamine acceleration is probably best, with litharge and sulfur helping. One good system is Accelerator 808,[5] 2.0 PHR; litharge, 10.0 PHR; and sulfur, 2.0 PHR.

Q. What accelerator combination do you recommend for natural and GR-S type rubber chemically blown sponge, cured in rolls, continuously moving through press, in thicknesses from ⅛- through ⅜-inch?

A. Chemically blown sponge that is processed through a continuous cure cycle in thickness of ⅛- to ⅜- inch can be accelerated with a combination of a thiazole such as N-cyclohexyl-2-benzothiazole sulfenamide and DPG. This is particularly true when working with GR-S rubber sponge.

Natural rubber sponge can also be produced with such an acceleration. As an alternate a combination of a thiazole with a thiuram may be used, and this is excellent in natural rubber. In natural rubber a combination of MBTS and tetramethylthiuram monosulfide in a ratio of about 90/10 to 85/15 gives a good lively sponge.

In a GR-S type chemically blown sponge the accelerator content usually runs fairly high owing to the large amount of oil that is usually employed, being around 1.5% of Santocure and 1.5% of DPG on the rubber content. The sulfur content is usually up around 3.5 or 4% on the rubber for the same reason.

Q. Is it necessary to sacrifice good physical properties to accomplish a rapid cure rate in natural rubber mechanical goods compounds?

A. Neal. The problem here is to produce a stock which will have a very good plateau effect and still give a rapid rate of cure. For most cures the use of a substantial amount of a thiazole as the primary accelerator activated with a thiuram monosulfide will give a sufficiently rapid rate of cure without sacrificing any of the aging characteristics or other desirable properties of the finished vulcanizate.

It is recognized that in a few cases where extremely rapid cures are necessary, this above-mentioned combination may not be quite fast enough. Conventionally these cases have been handled by using a thiuram as the accelerator. Such stocks, of course, do have a tendency to have a peak type of cure, with properties falling off rapidly on overcure. A method of overcoming this difficulty without sacrificing speed of cure might be, however, to use a high amount of a thiazole as the primary accelerator and activate it with a small amount of an aldehydeamine such as 808. Such stocks will have a very rapid rate of cure, a good plateau region allowing maximum flexibility in curing cycles, but will be extremely scorchy and difficult to process in the factory.

An alternate suggestion which was used successfully by several manufacturers in the days of natural rubber inner tubes was to use a thiazole such as Zenite[5] and activate it with a combination of a small amount of Thionex[5] and some DOTG.

Q. What effect does a rubber accelerator have upon viscose yarns, if any?

A. Baker. As far as we know, there is no apparent effect on viscose yarns when in contact with any of the commercially used rubber accelerators. Experimental work with viscose yarns in contact with much higher concentrations of accelerators than would be encountered in practical compounding did not indicate any deterioration.

Under certain conditions viscose yarns may present color problems with certain accelerators. The conditions imposed upon the yarn may be of greater importance than the accelerator. Color change is more likely to be influenced by antioxidants than by accelerators.

Q. Are there new accelerators or curing systems which are safer processing and which produce compounds that display longer bin aging characteristics?

A. Davis. The newest benzothiazolsulfenamides such as NOBS-Special, etc. give safer processing and longer bin aging characteristics than earlier accelerators. The heat history of the stocks, however, must be controlled in order to get the best processing safety and bin aging from these good delayed-action accelerators.

Q. What acceleration is most satisfactory for Earthmover and off-the-road treads and carcass stocks?

A. Baker. Earthmover and off-the-road type treads require a stock that is high in tear resistance and chunking resistance. The thiazole-type accelerator is good for this type of service, and in addition it is a non-reverting-type accelerator which is necessary because of the long cure required for such stocks. The thickness of the extruded tread is such that a delayed-action accelerator is very desirable. Santocure, NOBS, NOBS Special, and Santocure NS are suitable accelerators for such treads and carcasses. These stocks are mostly natural rubber, and the carcasses are almost sure to be all natural rubber since they are less likely to bruise.

Q. Are there accelerators and/or curing

[9]See *Ind. Eng. Chem.*, Aug., 1955, pp. 1562-69.

systems which are inactive at processing temperatures that can be treated with atomic radiation or other means to make the compound highly active at (a) curing temperatures; (b) room temperature?

A. Neal. The use of atomic radiation as a means of vulcanizing elastomeric materials is still in its infancy, and no practical system has yet been devised. Theoretically any material which can be vulcanized by a peroxide should also be capable of being vulcanized by radiation, and since most of the common elastomers fall into this class, it is not too much to hope that some time in the future practical systems may be developed. This observation is particularly true since the production of electrical power from atomic processes is accompanied by the production of waste products which are a potent and economical source of active radiation.

It would be anticipated that the unvulcanized stocks themselves would be extremely inert until subjected to radiation, and, therefore, processing difficulties would be reduced to a minimum. Experimental work has already been carried out with both beta and gamma radiation. The use of beta radiation would be restricted to thin-walled articles, but this limitation should not be encountered with gamma radiation. One of the major experimental difficulties so far encountered with this type of curing has been the prevention of drastic overcures.

Q. Why should retarders be used?

A. Garvey. Logically, it is rather hard to justify the use of retarder with an accelerator, and generally it is possible to develop suitable acceleration without retarders. In some cases, however, the use of a retarder may give the best or simplest answer.

(1) The best combination of properties may be obtained with a compound which is just a little too scorchy. A retarder may make the compound operable without sacrifice in quality. It may be quicker and easier to use this combination than to develop an entirely new type of acceleration.

(2) A compound may work well in winter, but give excessive trouble in hot weather. The addition of retarder in hot weather may eliminate the need of more drastic changes, and the retarder can be removed from the recipe when the weather again gets cold.

Q. For a given GR-S type tread compound cured with the conventional sulfur, accelerator systems, is the temperature coefficient of vulcanization rate a true constant, or does it vary with temperature?

A. Baker. The temperature coefficient of vulcanization rate is not a true constant. It varies with the temperature, accelerator, and compound used.

Q. What effect does high-processing temperatures in the absence of sulfur have on the curing strength of accelerators?

A. Davis. Holbrook and Fitzgerald have shown that two minutes at about 360° F. in the absence of sulfur cause a moderate to severe decrease in the curing strength of a number of accelerators.[10]

Q. What are the accepted accelerators or curing systems used in natural and synthetic rubber latices?

A. Waterman. The following accelerators are widely accepted for latex use: activated dithiocarbamates, dithiocarbamates, thiazoles, and thiurams.

Less widely used are aldehydeamines, guanidines, and thioureas.

The curing systems used are:

	Natural	GR-S Type	Neoprene	Nitrile
Vulcanizing agent	sulfur	sulfur	zinc oxide	sulfur
Activator	zinc oxide	zinc oxide		zinc oxide

Q. What are the differences in acceleration between dry heat cure and steam cure in foam rubber?

A. Waterman. The two acceleration systems are essentially the same except that dry heat cure requires an additional 1.5 parts of an activated dithiocarbamate.

The two curing systems then are:

	Steam Cure PHR	Dry Heat PHR
Zinc oxide	5	5
Sulfur	2	2
Zinc mercaptobenzothiazole	1	1
Dithiocarbamate	1	1
Aldehydeamine	1	1
Activated dithiocarbamate	—	1.5

Q. What effect does high-processing temperatures in the absence of sulfur have on the delayed action of benzothiazole sulfenamides?

A. Davis. It has been found that two minutes' exposure of benzothiazole sulfenamides to a temperature of about 350° F. in the absence of sulfur, but in rubber containing furnace black appears to eliminate completely the good delayed action these accelerators normally possess.

Q. What acceleration systems would be used to produce drug sundry items?

A. Waterman.

	Low Modulus PHR	High Modulus PHR
Zinc oxide	0.5	2
Sulfur	0.25-0.33	1.5
Zinc mercaptobenzothiazole	0.5	—
Dibutyl dithiocarbamate	0.35	—
Tetramethylthiuram disulfide	—	1.0

Q. Is there an optimum sulfur level to be used with different accelerators?

A. Garvey. Yes. For the best compounds with each accelerator there is an optimum sulfur level within rather narrow limits. There is, of course, some spread, and the best level will depend partly upon pigment, softener, etc. This does not mean that good compounds cannot be made at other sulfur levels. In some cases where special combinations of properties are desired, or where special types of compound are being used, the sulfur-accelerator ratios may be quite different from what we usually consider the optimum. In natural rubber I would put the optimum sulfur levels approximately as follows: aldehydeamines — 3-5 PHR, thiazoles — 2-4 PHR, thiuram — 1-1.5 PHR.

Q. Are aldehydeamines used to any great extent in present-day compounding?

A. Baker. Aldehydeamines are not used to any great extent in present-day compounding. Their largest use is in the curing of hard rubber and in latex foam. Trimene base is the one used in latex foam; while in hard rubber there are several that can be used.

Q. If a dry powder mixture containing a benzothiazole sulfenamide, DPG, and sulfur, as required for a tread stock, is stored for 24 hours at about 105-110° F. (outside the rubber), what effect will this have on the scorch and cure rate when this mixture is used in the tread stock?

A. Davis. Such a treatment of these accelerators and vulcanizing agent causes a marked decrease in the scorch time or processing safety and also an increase in the rate of cure of the resulting tread stock.

Q. What are normal curing systems for neoprene and nitrile latex foam?

A. Waterman.

For nitrile latex foam:

	PHR
Zinc oxide	3
Sulfur	2
Zinc mercaptobenzothiazole	2
Activated dithiocarbamate	0.25-0.5

For neoprene latex foam:

	PHR
Zinc oxide	7.5
Sulfur	2
Zinc dibutyldithiocarbamate	2
Activated dithiocarbamate	1

Cell tack is not necessarily an indication of undercure in either neoprene or nitrile foam.

Predicts Urethane Output

Production of polyurethanes in the United States will reach a yearly output of 100,000,000 pounds by 1960, Richard B. Greene, coordinator for plastics and resins of Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., told a meeting of the Society of the Plastics Industry at the St. Francis Hotel, San Francisco, Calif., March 28.

He also forecast that the final products of urethane research will be quite different from those now being made and said that this new class of materials should provide a challenge to American chemists. He noted that work on the polyurethanes first began 20 years ago, but only in the last five years has the field been opened for extensive exploration and development.

Among the possible applications of polyurethanes, Mr. Greene listed protective finishes, wire insulation, can coatings, textile covering, and coatings for magnesium, iron, and zinc.

[10] See *Rubber Age (N. Y.)*, Oct., 1948, pp. 57-59.

Rubber Division Schedules Eight Papers For CIC Meeting; Expect 1500 Attendance

Eight technical papers will be read to the May 30 meeting of the Rubber Division of the Chemical Institute of Canada during the Institute's thirty-ninth annual conference and exhibition at the Sheraton-Mt. Royal Hotel, Montreal, P.Q., Canada, May 28-30. G. J. Baxter, Firestone Tire & Rubber Co. of Canada, Ltd., is chairman of the Rubber Division.

More than 1,500 chemists, chemical engineers, and others are expected to attend the conference. The exhibition will feature latest developments in laboratory and chemical process equipment, scientific instruments, chemicals, and technical literature. Forty manufacturers and distributors will take part.

Among the scheduled guest speakers is Louis F. Fieser, professor of chemistry at Harvard University, who will deliver the Leroy Egerton Westman Memorial Lecture, May 29, speaking on the oxidation process developed by the late Samuel C. Hooker.

An address on "The Biogenesis of Alkaloids" is also scheduled by Leo Marion, National Research Council of Ottawa. He will be presented the Chemical Institute of Canada Medal "in recognition of his outstanding contribution to chemistry."

Abstracts of the Rubber Division papers are published below.

Wednesday, May 30
G. J. Baxter, Presiding

9:30 a.m. Behavior of Rubber Vulcanizates Containing a Variety of Fillers. B. B. Boonstra and E. M. Dannenberg, Godfrey L. Cabot, Inc., Boston, Mass.

The fillers studied in vulcanizates made from GR-S type rubber, natural rubber, neoprene, and acrylonitrile-butadiene copolymer rubber included representative groups of carbon and non-carbon pigments in formulations adjusted for maximum tensile properties.

The reinforcement characteristics of these fillers, as measured by effect on modulus, tear resistance, abrasion, etc., run parallel in the different elastomers. Though this study gives a broad picture of the reinforcing properties of the pigments, the ultimate choice of the type and amount of filler depends upon the particular application.

The degree of interaction of the various fillers and polymers was determined by swelling and modulus measurements. With carbon blacks, the unvulcanized and vulcanized matrix is significantly changed in its behavior toward liquids.

This fact is evident from the observation of bound rubber phenomenon and the reduced swelling of the rubber portion of a loaded compound as compared with the pure gum vulcanizate. This reduction in swelling increases with the loading of black and is particularly pronounced with the more reinforcing blacks.

White pigments do not show such regular behavior, and, in some instances, the swelling of the matrix is completely unaffected by the presence of pigment. This is observed with some of the most reinforcing white fillers. Bound rubber phenomena are seen with both white and black fillers.

10:00 a.m. The Properties and Applications of Coral Rubber, a *Cis* Polyisoprene. Glen Alliger, J. M. Willis, W. A. Smith, Firestone Tire & Rubber Co., Akron, O.

Coral rubber is a high molecular weight polyisoprene having the essential molecular structure of natural rubber and prepared by lithium catalysis. As a result of this structural similarity, Coral rubber is like natural rubber in its properties.

In particular, Coral rubber has the low heat build-up (i.e., low hysteretic loss), the good retention of strength at elevated temperatures, and the good resistance to tear and cut growth which are characteristic of natural rubber. Coral and natural rubber are similar in their reactivity to sulfur and oxygen. This similarity manifests itself in similar vulcanization and aging characteristics.

These properties of Coral rubber suggest that it should be suitable for certain tire and non-tire products for which, heretofore, natural rubber has been the only satisfactory elastomer available.

In this connection, the butadiene-styrene copolymer made at 41° F. (cold rubber or LTP) is deficient with respect to some of the above critical properties. These deficiencies make LTP unsatisfactory for certain applications.

Although Coral and natural rubber are, in general, alike in properties, they are different in certain important respects. The possible effect on end-product application of these similarities and differences will be discussed in detail.

10:30 a.m. The Reaction of Molecular Oxygen with Rubber. G. M. Bevilacqua, United States Rubber Co., General Laboratories, Passaic, N. J.

Experimental work during the past few years has laid the foundation for an accurate understanding of the interaction of oxygen with raw rubber and its effect on the aging of vulcanized rubber.

Although direct experimental evidence for the reactions occurring during the oxidation of rubber is meager, the sequence of steps leading to the primary product of the oxidation of low molecular weight hydrocarbons has been worked out in great detail.

This, combined with what is known about natural rubber, enables us to set up a clear picture of the first step in the oxidation of rubber, formation of the hydroperoxide. Current work is concerned with the subsequent steps leading to chain scission and the formation of volatile products.

Detailed discrimination between the reactions occurring when vulcanized rubber is oxidized has become possible through the application of the "stress relaxation" technique introduced by Tobolsky. This work has shown that cross-links are rapidly attacked by oxygen in a process in which antioxidants for olefin oxidation are relatively ineffective.

11:00 a.m. Tire Cord—How Tangled Can It Get? R. W. Kolb, Dominion Textiles Co., Ltd., Drummondville, P.Q.

Tire fabrics evolved from the early cotton forms to the present-day high-tenacity rayon and nylon cords. This development will be discussed.

Inherent fiber properties, cord size, and cord geometry, when twisted, are related to such performance characteristics as tensile strength, load elongation, fatigue or flex-life, moisture behavior, adhesion to rubber, and cord growth, or instability in use.

Of necessity, these factors can be considered only in the light of the current, imperfect methods of evaluation. Limitations to the attainment of potentials, indicated by research, under production-scale manufacturing methods, will be reviewed, and recent improvements considered, together with possible developments in the future.

11:30 a.m. Annual Business Meeting.

2:00 p.m. Exposure Cracking of Sidewall Compounds. D. C. Edwards and E. B. Storey, Polymer Corp., Ltd., Sarnia, Ont.

Our study of the ozone cracking behavior of Polysar S sidewall compounds emphasized the combined action of an antiozidant and a protective wax. Three types of experimental procedure were evolved for this study, and the development and application of these techniques will be detailed.

The static exposure of spirally deformed specimens to a controlled ozonized atmosphere showed the effects of strain on the cracking. A microscopic study of strip specimens exposed at 20% strain provided information on the induction period, the number, and the growth behavior of the cracks.

The exposure of specimens mounted on the sidewall of a tire proved to be a simple and economical means of testing under conditions nearly identical to those of actual service.

Both the wax and the antiozidant decrease the number of cracks at a given strain. The antiozidant also retards the growth rate of the cracks. The protective action of combination of the wax and antiozidant is greater than would be predicted from the individual performances of the two agents, and the use of such combinations provides the best protection against cracking. Mechanical failure of the surface wax film was not observed in the sidewall test, even with loading of six parts of wax.

A test method was developed that provided a means of developing rubber compounds for the sidewall portions of automobile tires that had good resistance to weathering conditions in service, and will be discussed.

2:30 p.m. Useful Aspects of the Application of High-Intensity Nuclear Radiation in the Rubber Industry. S. D. Gehman, Goodyear Tire & Rubber Co., Akron.

Atomic power generation projected for the next decade will provide radioactivity in unprecedented quantities. Long-range estimates of the equilibrium amount of radioactive by-products which may accumulate in 50 years are of the order of 10^{11} curies. Constructive uses for the radiation

from spent fuel elements or separated fission products can contribute significantly to the development of economic atomic power and alleviate a serious disposal problem.

Research is beginning to show the possibility of applications of intense gamma radiation of interest for the rubber industry. This is basically due to the coincidence of the free radical nature of rubber chemistry and the potency of radiation as a source of free radicals, ions, and excited molecules.

Pile irradiated Co^{60} sources have been used in a wide variety of arrangements to explore the effects of intense gamma radiation on materials and chemical reactions. Intense radiation has unique features as an initiator for polymerization reactions and provides opportunities for the development of new types of synthetic rubber, especially graft polymers.

As a promoter of cross-linking, irradiation can serve to raise the softening point of some plastics, increase solvent resistance, and improve physical properties. Most types of rubber can be vulcanized by irradiation, although a relatively large dose is required. Such vulcanizates are generally distinguished by exceptionally good aging properties.

Practical use of radiation for such purposes is contingent on cheaper sources and extensive developments in the technology of working with large amounts of radioactivity. The rubber industry should have an especial interest in the development of multi-purpose nuclear reactors adapted to furnish operating power, process heat, and intense gamma radiation.

3.00 p.m. The Synthesis and Polymerization of Vinylidene Cyanide Darlan Fiber Comonomer. J. E. Jansen, B. F. Goodrich Co. Research Center, Brecksville, O.

Vinylidene cyanide, the precursor to the new man-made fiber, Darlan, may be synthesized by the pyrolysis of 1,1,3,3-tetracyanopropane, 1,1-dicyanoethyl acetate or 4,4-dicyanocyclohexene.

The monomer, which must be stabilized by acidic materials during pyrolysis and storage, homopolymerizes by an anionic process in which water, alcohols, amines, and ketones serve as catalysts. Copolymers may be formed with a wide range of common monomers in non-aqueous systems by a free radical initiated reaction.

The copolymers, in contrast to the homopolymer, are stable to moisture, bases, and heat. These copolymers may be processed into fibers, films, and molded goods. Vinylidene cyanide reacts, in the presence of anhydrous aluminum chloride, with aromatic hydrocarbons, phenols, phenol ethers, and certain aromatic heterocycles to give monosubstituted malononitriles.

Diels-Alder adducts are readily formed with vinylidene cyanide and most dienes.

Darlan fiber, a copolymer of vinylidene cyanide, is presently being manufactured on a semi-works scale and is being tested for consumer acceptance in sweaters, pile, and suiting fabrics.

3:30 p.m. Use of Polyethylene in Blends with Cold Rubber. Paul G. Carpenter, Phillips Chemical Co., Bartlesville, Okla.

The new low-pressure polyethylene, as exemplified by Marlex 50, has been shown to convey interesting properties to vulcanizates comprising this polymer and cold rubber with or without carbon black.

Gum stocks are found to be reinforced to a much greater extent than is possible with conventional polyethylene. In shoe sole compounds Marlex 50 polyethylene compares favorably to high styrene resins conveying good tear resistance, stress-strain properties, flex life (De Mattia crack growth test at 210° F.), and excellent resistance to abrasion (NBS abrader).

Combinations of Marlex 50 polyethylene with low levels of HAF carbon black have led to the development of tire tread stocks with excellent road-wear characteristics as shown in actual tire tests. These treads operate at lower temperatures (decreased heat build-up) than do normal cold rubber-HAF carbon black compounds and may find useful applications in heavy-duty truck tires.

It is expected that further developments will be forthcoming based on properties conveyed by Marlex 50 polyethylene to cold rubber compounds.

Northern California Meets

The Northern California Rubber Group, meeting April 12 at the Elks Club, Berkeley, Calif., heard William Winter, news commentator with the American Broadcasting Co., discuss "News behind the Headlines," a political appraisal of the Far East, Israel, and Near East Arab countries. Sixty-five members and guests were present.

The evening dinner-meeting honored past presidents of the organization.

G. R. Steinbach, Merit Western Co., addressed the Northern California Rubber Group at the Elks Club, Berkeley, Calif., March 1, on rubber growing in southeast Asia.

This talk was illustrated with colored slides taken by Syd Pike, S. J. Pike & Co., Inc., on his recent tour of rubber plantations there. Mr. Steinbach described the techniques of tapping, collection, crude production, classification, storage, and shipping.

Fort Wayne Hears Jones On High-Speed Extrusion

A paper entitled "Factors Relating to High-Speed Extrusion" was presented by J. H. Jones, Bakelite Co., to the Fort Wayne Rubber & Plastics Group at the Van Orman Hotel, Fort Wayne, Ind., April 12. Attendance was 143. Co-author of the treatise, B. H. Maddock, also of Bakelite, contributed to the discussion.

Expressing his opinion that plastics extruders today were producing at rates far short of their capacity and that higher speeds were feasible, Mr. Jones described a newly developed 2½-inch electrically heated extruder that can operate successfully at 125 rpm., producing 1¼-inch polyethylene pipe at the rate of 188 pounds an hour.

Expounding on the theory of extrusion, he presented the following equation for the extruder discharge rate:

$$Q = \alpha N - \beta/\eta P,$$

where
Q is the volume rate of discharge,
N is the screw speed,
P is the pressure,
α is the forward flow constant (screw dimensions only),
β is the back flow constant (screw dimensions only),
and η is the resin viscosity.

This equation was shown to be a straight-line function.

Mr. Jones discussed the effect of channel depth on extruder output, declaring that increasing channel depth results in higher delivery rate at low pressure (large dies), but the back flow may be increased to the extent that the output at high pressures (small dies) is actually reduced.

Typical data for several metering-type screws (I and II) and decreasing pitch-type screws (III and IV) and their relation to output rate were shown on a slide. It was seen that screw I (two-inch pitch metering) gave the lowest delivery rate because of the shallow channel.

The Bakelite technical representative said that the resistances which govern the amount of pressure developed by the screw increase with increasing land length and with decreasing cross-sectional area. This condition gives rise to a family of curves for dies of different resistance which was shown on a slide.

Recalling that extruder delivery rate depends on the pressure developed in the head, Mr. Jones showed another slide illustrating this point. By superimposing these two slides, the operating characteristics of the extruder, including the die, were completely described.

Ready Plastics Exposition

The Seventh National Plastics Exposition will be held June 11-15 at the recently completed Coliseum, New York, N. Y., together with a concurrently running business and technical conference at New York's Hotel Commodore, according to The Society of the Plastics Industry, Inc., sponsor of the affair.

The show, not open to the public, is expected to attract a record 20,000 people, representing industry, business, retailing, and government. Upward of 225 individual company exhibitors will occupy more than 300 booths totaling some 70,000 square feet of exhibit space.

Tentative plans for the technical sessions call for conferences in the cellular plastics, and plastics uses in the automotive, packaging, building, refrigeration, and air conditioning fields. A management and business symposium will also be held.

A special feature of the event will be the awarding of prizes to professional architects, draftsmen, designers, and architectural students who have submitted winning designs in the SPI's recent plastics house competition.

Exposition manager is Clapp & Poliak, Inc., New York, N. Y.

Fort Wayne Has Panel Discussion Program on Ozone Resistence

The meeting of the Fort Wayne Rubber & Plastics Group held at the Van Orman Hotel, Fort Wayne, Ind., on February 9, was featured by a panel discussion program on the subject of "Ozone Resistance of Rubber Compounds." H. A. Winkelmann, Dryden Rubber Division, Sheller Mfg. Corp., was the moderator for this discussion. Members of the panel comprised W. J. Simpson, Chrysler Corp.; A. J. Kearfoot, General Motors Corp.; F. W. Wilcox, Witco Chemical Co.; J. B. Littman, Packard Electric Division; J. F. McWhorter, Ohio Rubber Co.; and Harold L. Crooke, Ford Motor Co.

Attendance totaled 160.

Automotive Rubber Parts

By W. J. Simpson

Chrysler Corp.

Rubber parts used in exterior locations on automobiles and trucks, particularly when stressed in use, must be carefully engineered and controlled to prevent cracking and deterioration due to weather aging. Weatherstrips, grommets, etc., receive the most attention, not because cracking prevents these parts from functioning properly, but usually because cracking, checking, and other types of weather deterioration result in an unsightly appearance.

Some parts like hose, even though used more or less under cover, must also be carefully controlled to prevent ozone deterioration since serious cracking of such parts could affect their usefulness.

Automobile manufacturers run both qualification and product control tests on rubber parts in order to be sure they have proper weather resistance. Qualification tests are run on both standard samples such as described in ASTM D1171-51T, Weather Resistance Exposure of Automotive Rubber Compounds,[1] and also on sections of actual parts. Usual practice is to mount the sample around a two-inch mandrel (although different consumers of rubber parts may vary somewhat from this practice) and then expose the mounted specimens either to ozone in a laboratory apparatus or outdoors in various geographical locations. Tests to control incoming shipments are usually run in the same manner on samples by taking sections from the actual parts.

ASTM D1171-51T was developed by the SAE-ASTM Technical Committee on Automotive Rubber, which committee is made up of representatives of both automobile companies and companies producing automotive rubber parts. The method does not describe where the samples should be exposed or for how long. There are considerable differences in the type of exposure and location, if outdoors, used for this test. Some laboratories send samples to Florida, some to Los Angeles, Calif., some to various other locations, and many use laboratory test equipment.

Many companies use both outdoor exposure and laboratory ozone testing for evaluation of rubber parts. Laboratory testing in ozone cabinets is becoming popular because such tests are shorter than outdoor exposure tests, especially for checking incoming shipments of material that has passed previous qualification tests. The outdoor exposure tests are more often used for original approval of vendors' material. Many automobile companies, however, supplement laboratory ozone tests on rubber parts periodically with outdoor exposure tests.

The method and apparatus most commonly used for laboratory ozone testing of rubber products are described in ASTM D1149-51T, Accelerated Ozone Cracking of Vulcanized Rubber, which is based on the paper by Crabtree and Kemp.[2] The use of this method has been criticized as a means of controlling the quality of rubber parts because of poor reproducibility of the test results. Most of the automobile companies are using D1149-51T, however, because it is the best test available at the moment, and since, with experience, reasonable duplication of test results has been obtained.

Formerly most ozone tests with D1149 were run for 70 hours at 100° F. in an atmosphere containing 25 pphm. of ozone. Higher concentrations of ozone are now being used because readings higher than 25 pphm. are found outdoors in certain locations, especially when smog conditions are present.

The use of weathering tests (laboratory ozone or outdoor) by automobile manufacturers has increased considerably during the last few years in their efforts to be sure the rubber parts they use will withstand the apparent increased severity of weather on such rubber products. Constant vigilance will be required by both the producer and consumer of automotive rubber parts to maintain and improve their resistance to weather aging.

[1] "ASTM Standards on Rubber Products." American Society for Testing Materials, 1916 Race St., Philadelphia, Pa.

[2] *Ind. Eng. Chem., Anal. Ed.*, Dec., 1946, p. 769.

Laboratory vs. Outdoor Ozone Testing

By A. J. Kearfoot

General Motors Corp.

The cracking of rubber products under stress in service or storage is a major problem confronting the rubber products manufacturer and user. Outdoor weathering tests sometimes take months or even years to obtain the necessary evaluation of rubber compounds. One of the most deleterious materials that affect rubber parts under stress during outdoor exposure is ozone. It is desirable to have a reliable shorter laboratory test method since the concentration of ozone in the air varies considerably at different locations, temperatures, and times.

Although laboratory ozone cabinets for testing rubber products have been in use for some years, the most concentrated efforts to obtain a reliable, easily controlled ozone test method have been made in the recent past. The latest methods of laboratory testing and evaluating the results have been subject to some controversy. Some users of rubber products request an ozone test in spite of this controversy; some require a test made at a concentration of 50 pphm. of ozone at 100° F. for varying lengths of time.

It would be desirable in the laboratory testing of rubber products for ozone resistance to have ozone concentration, temperature, and time automatically recorded. In general, rubber samples that last the longest time in a concentration of 50 pphm. of ozone also give the longest service life outdoors. Correlation between laboratory ozone resistance and outdoor exposure is by no means exact, however, at the present time.

General Motors has an accelerated weathering subcommittee which is studying the effect of ozone on rubber products, and different types of ozone test equipment are being used. The control of test conditions with some of this equipment is difficult within reasonable limits. Laboratory ozone testing in comparison with outdoor weathering tests on rubber parts is being carried out according to the program of the joint SAE-ASTM Technical Committee on Automotive Rubber, and tests are also being run under the same stresses the parts encounter in service. It is hoped that improved control of the test conditions in the laboratory equipment will permit better correlation of laboratory ozone testing and outdoor testing.

Wire and Cable

By J. B. Littman

Packard Electric Division

The problem of ozone resistance of wire insulations and jackets is not too different from when rubber is used for other applications, except where the ozone concentrations are higher, owing to the corona effect of high voltage on such insulation. In places where ozone is generated, such as near electrical transformers or under the hood of the automobile, the ozone concentrations are somewhat higher than

in the normal atmosphere. For a great many uses of insulated wire, such as lamp cords or lead-in wire to household appliances, the ozone problem is similar to that with other rubber products. The accepted ozone concentration for general-purpose testing of rubber products is from 25 to 100 pphm.; whereas for the insulated wire industry the test requirements are for ozone concentrations as high as 15,000 pphm.

Developments over the past 25 years in improving the ozone resistance of wire and cable insulation are reviewed briefly, as follows. The first method of compounding to improve insulation resistance to ozone was the use of a recipe which would provide high permanent set and low modulus characteristics. The first ignition cables were made using three layers of rubber. The outer, ozone resistant jacket consisted of a small amount of natural rubber loaded with reclaimed rubber, mineral rubber, factice, and waxes. This type of compound was satisfactory until voltage requirements for cable were raised, and it became necessary to cover the insulation with braid and lacquer.

When neoprene synthetic rubber became available, further improvements in ozone resistance were made possible by using this rubber for the automotive cable jacket. Although voltages have increased fourfold, it has not been necessary to change the physical dimensions of the cable.

New chemicals recently introduced show considerable promise in improving the ozone resistance of wire and cable insulation. These materials, called antiozidants, may improve the ozone resistance of rubber compounds as much as antioxidants have improved their resistance to oxygen and shelf aging. The wire and cable industry welcomes all new developments that will enable it to keep up with the demands for insulation with increased ozone resistance, particularly for insulation used in the modern automotive engine.

Lab Ozone Test Method

By F. W. Wilcox
Witco Chemical Co.

The accelerated laboratory apparatus test method for determining the relative ozone resistance of rubber compounds consists of an enclosed chamber in which the specimens are exposed under strain (usually around 20%) to a low but precisely controlled concentration of ozone circulated across the surface of the samples. In ASTM D1149 an ozone concentration of 25 pphm. and a chamber temperature of 90-120° F. are specified. The recent trend, however, is to use higher ozone concentrations and a test temperature of 100° F. The exposed specimens are examined at frequent intervals and rated for degree of cracking.

The above-mentioned test method, if properly conducted, gives fairly reproducible results in any one ozone cabinet. The correlation of results, when several ozone cabinets are used, however, has not been too gratifying to date. This fact was demonstrated recently in a round-robin test program conducted by SAE-ASTM Technical Committee on Automotive Rubber, subsection IV-P. In this program three stocks were evaluated in ten different ozone cabinets operated by various laboratories. While every effort was made to keep the operating conditions as uniform as possible for this test, the degree of cracking of the specimens varied quite widely from one laboratory to another. It is quite possible that some of the differences could be attributed to the human element, such as in rating the degree of cracking of the specimens, or to failure to maintain the proper ozone concentration within the test chamber.

It is more likely, however, that mechanical operating conditions differ sufficiently from one cabinet to another to cause some of the variations in test results. The rate of flow of ozone through the test chamber, the temperature and humidity of the air entering the cabinet, and the number of specimens exposed at any one time are all variables which have never been fully evaluated for their effect on exposure cracking.

In spite of these difficulties, however, the laboratory ozone cabinet test, as it is now run, is relatively quick and affords a good method of screening compounds whose outdoor exposure characteristics have previously been determined.

The use of the apparatus is still in the experimental stage, and more time is needed to determine the relation between tests made with various ozone concentrations in the cabinet and outdoor exposure tests and also the effects of varying the temperature in the cabinet. We do know that wax-protected compounds exposed at 120° F., for example, do not necessarily give the same degree of cracking as when exposed at much lower temperatures. In some instances exposure at the lower temperature produces more severe cracking.

The laboratory ozone cabinet method of testing for ozone resistance has not yet been developed to the stage where it can be used to replace outdoor exposure testing according to our experience.

Ford Weather Aging Method

By Harold L. Crooke
Ford Motor Co.

The Ford Motor Co. weather aging method involves subjecting the various automotive parts to about the same degree of stress as they receive in service (15 to 35%), and after a period of 24 hours for relaxation, the sample is placed into a laboratory ozone cabinet at a concentration of 100 pphm. and a temperature of 100° F. for a period of 70 hours.

Rubber parts that show no cracks after this test are considered satisfactory for most service conditions, except those extreme conditions where mixtures of air high in ozone and nitrous oxide fumes are present. In this latter case the deterioration of the rubber part proceeds at an accelerated rate.

Evaluating Outdoor Tests

By J. F. McWhorter
Ohio Rubber Co.

In an effort to develop a quality retention rating for automotive weatherstrip compounds exposed at various locations in the United States, samples of eight different such compounds were prepared according to ASTM D1171-51T and exposed for six-week periods in 18 different locations between January, 1952, and August, 1953. The effect of factors such as time of exposure, temperature, weather conditions, and mandrel material was observed and considered in connection with the evaluation. Compounds used were classified as a good GR-S type rubber compound, a good natural rubber compound, a good and a poor ozone resistant neoprene compound, sponge body, sponge skin, a poor natural rubber reclaim compound, and a butyl rubber compound.

Exposure locations consisted of three in California, two in Florida, three in Illinois, and one each in Texas, Arizona, Delaware, Michigan, New York, Ohio, Massachusetts, Indiana, Michigan, and Colorado.

A system of evaluation was worked out based on crack growth reading taken every second week, with ratings 0, 1, 2, 3 in groups of three, as follows:

Crack Growth	% Quality Retention
000	100
001	95
011	90
111	85
002	80
012	75
112	70
022	65
122	60
222	55
003	45
013	40
113	35
023	30
123	25
223	20
033	15
133	10
233	5
333	0

The data collected and evaluated with the above system revealed the following facts. The general pattern for exposure test results from the Midwest locations was similar with the exception of Buffalo, N. Y., at which location there was insufficient information to evaluate correctly. The differences between Willoughby, O., and Chicago, Ill., the two most severe Midwest locations, and Detroit, Mich., the least severe location, may be due to conditions existing in the immediate local test area rather than the general area, it was said.

Denver, Colo., and Mare Island, Calif., have patterns similar to those of the Mid-

west group, except Denver exposure was more severe at 35° F. Long Beach, Calif., is far more severe than other areas. The two Florida locations are the least severe exposure areas even though the temperatures at those areas were higher.

Temperature has to be evaluated as a variable of the particular test location under consideration. The temperatures used in this work were obtained from Department of Commerce records and not from measurements at the time of the test.

The material from which the mandrels on which the samples were mounted was not found to affect the test results.

No correlation was observed between the records for humidity, as obtained from the Department of Commerce for each location, and the quality retention of the exposed samples.

It was not possible at the time these exposure tests were made to obtain atmospheric ozone concentration data for the various test locations.

As a result of this work, the procedure and the evaluation table based on a six-week exposure period in outdoor locations in various parts of the country are recommended for the evaluation of commercial weatherstrip compounds.

It is recognized that exposure periods of longer or shorter than six weeks might be used, but a different grouping of quality standards would be necessary.

Goodyear's Drew Discusses Tire Cords at Washington

"New Developments in Tire Cords" was the subject of an address by P. W. Drew, The Goodyear Tire & Rubber Co., before 49 members and guests of the Washington Rubber Group at the Pepco Auditorium, Washington, D. C., March 21.

The Goodyear manager of fabric development limited his discussion to the high-modulus fibers cotton, rayon, nylon, Dacron, glass, and wire, which can be used in the manufacture of tires, and briefly touched upon the function of cords in tires, the construction of the cords in terms of twists, and the processing and adhesive treatment of the cords.

Dismissing the use of cotton cord in today's tires as too high in cost and too low in quality, he went on to a review of rayon in tire cord from its introduction in 1928 to Du Pont's introduction in 1952 of a super-type rayon 20% stronger in tensile strength and 25% better in fatigue resistance than standard rayon, through that company's recent development of a super-super rayon that is 10% stronger than super-type rayon and of equal fatigue resistance.

Terming nylon the most interesting of the new tire fibers, Mr. Drew said he believed it to be the basic tire fabric of the future and praised it as a material that performs in tires much better than test data would indicate.

Although nylon is stronger and has better bruise and fatigue resistance than any other available fiber, its main limiting factor was seen to be its high price, despite recent decreases. Its advantages were listed as light weight, strength, greater elasticity, and superior high-speed performance.

Nylon cord requires more processing with costlier specialized equipment than either cotton or rayon. Nylon is difficult to process and requires careful temperature control during the tire-making process. Since rayon is more affected by moisture than heat, and nylon is a thermal plastic material, entirely different processing methods are needed for the two materials.

Wire cord was said to be used where heavy loads or puncture resistance is the major service problem; while glass cord is used only where extreme heat is encountered. The limiting feature of both of these materials is the lack of flexibility, and tires employing them must be designed where little actual flexing is required.

The speaker thought Dacron showed possibilities in future development of tire cords, but it is so far too expensive, loses fatigue resistance too easily, and bonds to rubber only with great difficulty. Celanese's Fiber X36 was also said to have possibilities.

Address on Nitrile Rubbers by Duke at Rhode Island

"Factors Influencing the Oil Resistance of Nitrile Rubbers" was the subject of a talk by N. G. Duke, B. F. Goodrich Chemical Co., before 197 members and guests of the Rhode Island Rubber Club at the Pawtucket Golf Club, Pawtucket, R. I., April 5.

Limiting his discussion to copolymers of butadiene and acrylonitrile, the Goodrich researcher pointed out that oil resistance is the most important property of nitrile rubbers and the reason they are used so extensively, despite their costing more than natural or GR-S type rubbers.

Duke traced the history of the development of nitrile rubbers and outlined the techniques of their manufacture today. There are only six major producers of nitrile rubber in the world, four of which are in the United States. These are Goodrich (Hycar); Goodyear Tire & Rubber Co. (Chemigum); Naugatuck Chemical Division (Paracril); Firestone Tire & Rubber Co. (Butaprene); Polymer Corp., Ltd., Canada (Krynac); and Farbenfabriken Bayer, Germany (Perbunan).

A French patent issued in 1931 contained the first literature reference to nitrile rubbers. In 1938, Goodrich produced the first American-made nitrile rubber, making it available commercially in 1941 in a joint undertaking with Phillips Petroleum Co. That same year Standard Oil Development Co. obtained a United States patent for the manufacture of copolymers of butadiene and acrylonitrile in the range of 10-40% acrylonitrile.

Moving into the technical aspects of his talk, the speaker said that carbon blacks do not have any appreciable effect on the resistance of nitrile rubber to swelling in an aromatic fuel. Data were also presented showing that certain softeners were not only non-extractable by aromatic fuels, but swelled about the same amount as the nitrile rubber.

GR-S type rubbers may be used to counteract shrinkage by softener extraction when a tight seal for an oil with a high aniline point is desired. In certain aliphatic mineral oils, however, nearly 30% of GR-S is required to offset the shrinkage caused by the extraction of the 20 parts of ester-type softener.

Pointing out again that modulus variations due to different types of loading had little effect on volume swell, Duke noted that wide modulus variations due to state of cure might show some correlation with volume change.

The speaker concluded his talk with a discussion of the new carboxylic modified nitrile rubber developed by Goodrich Chemical during the last year or so. Compared with a conventional nitrile rubber of equivalent oil resistance, the carboxylic modification exhibits much higher tensile and modulus, lower elongation, higher hardness, much improved hot tear and tensile strength, better low-temperature brittleness, and better retention of physical properties after hot oil and air aging.

The evening's after-dinner speaker was Norris D. Hoyt, St. George's School, on "Racing the Kormaron across the Atlantic."

MIT Summer Course in Catalytic Polymerization

"Recent Advances in Catalytic Polymerization" will be the subject of a two-week special summer program to be given at Massachusetts Institute of Technology, July 17-27. The program will consist of lectures, discussions, and demonstrations.

The course, intended for active and potential research workers in polymerization and allied chemical fields, will present and discuss current knowledge of catalytic polymerization, according to Ernest H. Huntress, director of the MIT summer session.

Avery A. Morton, professor of organic chemistry, will direct the program. Lecturers will include Walter H. Stockmayer, professor of physical chemistry; Edward J. Lanpher, of the MIT research staff; and several guest speakers.

Stressed in the course will be the new organo-metallic reagents which cause highly specific polymerizations of unsaturated hydrocarbons, such as olefins, dienes, and styrenes. Also to be studied are the presently known specific reagents for polymerization and a formulation of general principles concerning the mechanisms of catalytic polymerizations and the nature of the polymers produced.

Further details and application blanks may be obtained from the Summer Session Office, Room 7-103, Massachusetts Institute of Technology, Cambridge 39, Mass.

Detroit Group Campaigning for Wayne U Rubber Lab

The Detroit Rubber & Plastics Group, Detroit, Mich., has made a first contribution of $1,000 to a proposed $25,000 campaign fund for Wayne University's new rubber technology laboratory, which is scheduled to open for the fall semester.

The donation was presented by officers of the organization to University officials during a luncheon meeting at the Engineering Society of Detroit, April 3. The gift will supplement an existing rubber laboratory equipment fund of $3,500.

Accepting on behalf of the University were A. R. Carr, dean of the College of Engineering, and H. G. Donnelly, head of the Department of Chemical and Metallurgical Engineering. H. W. Hoerauf, chairman of the Group, and W. F. Miller, treasurer, made the presentation. Also present was R. W. Malcolmson, chairman of the Group's education committee.

Mr. Malcolmson expressed confidence that the balance of the $25,000 would be met with the combined assistance of the rubber industry and Detroit area industry who would benefit by the continued advances in rubber technology. The University itself will make available additional money from its departmental equipment fund and will defray expenses of equipment installation.

The new laboratory will supplement the rubber technology lecture courses which have been sponsored by the Detroit Group in cooperation with Wayne University for the past several years. About 600 representatives of rubber manufacturing and consuming companies have been enrolled in these courses.

According to Mr. Malcolmson, contributions to the fund should be sent to W. F. Miller, treasurer, Detroit Rubber & Plastics Group, Inc., c/o Yale Rubber Co., 3530 W. Fort St., Detroit, Mich.

Wayne University Photo

W. F. Miller, second from right, treasurer of the Detroit Rubber & Plastics Group, presents a $1,000 check from the organization to A. R. Carr, Dean of the College of Engineering of Wayne University, after luncheon ceremonies inaugurating a $25,000 drive for the University's rubber technology laboratory. Witnessing the formality are H. G. Donnelly, extreme left, head of the University's chemical engineering department, and H. W. Hoerauf, right, DRPG chairman

Biggs Talks at Detroit on Effect of Smog on Rubber

B. S. Biggs, Bell Telephone Laboratories, Inc., gave a talk on "Effect of Air Pollution on Elastomeric Products in the Telephone plant" before 150 members and guests of the Detroit Rubber & Plastics Group at the Detroit Leland Hotel, Detroit, Mich., April 13.

Dr. Biggs said that one reason air pollution is becoming an increasing problem in American cities is it results in the generation of ozone, which is deleterious to unprotected rubber. Ozone concentration in Los Angeles, for example, has been reported as high as 100 parts per 100 million of air.

The ozone results from the action of the ultra-violet component of sunlight on hydrocarbons in the atmosphere, in the presence of nitrogen oxide. The hydrocarbons come from such sources as automobile exhaust and industrial smoke. They become especially dangerous in the Los Angeles area because the topography and prevailing winds conspire to trap them.

The Bell researcher described comparative tests in accelerated laboratory ozone chambers and in the Los Angeles atmosphere with almost 100 experimental elastomeric compounds. The results indicated that resistance to smog conditions can be reliably predicted for neoprene compounds, but that correlation is not uniform with GR-S type rubbers.

He pointed out that detailed examinations of many neoprene-jacketed telephone wires in the Los Angeles area reveal no evidence of cracking even after exposures of several years. The GR-S samples that stood up best contained about four parts of wax and 3-4 parts of the newer antiozidants, such as UOP88.[1]

In general, Dr. Biggs believed that air pollution, as it is now being experienced in many industrial areas, is not a hazard for properly compounded elastomers in the telephone plant.

[1]Universal Oil Products.

B. S. Biggs

Herbert N. Bumpus, Michigan Bell Telephone Co., spoke briefly on "Recent Developments in the Communication Field." He demonstrated the microwave radio relay, transistors, and the solar battery. Two members of the Group were able to carry on a conversation using telephones powered by a small solar battery which used an electric light bulb as the energy source.

Praises Auto Rubber Use

More rubber will go into the car of tomorrow, D. E. Harpfer, assistant manager of industrial products development, The Goodyear Tire & Rubber Co., told the American Chemical Society at its one-hundred-twenty-ninth national meeting in Dallas, Tex., April 10.

Mr. Harpfer forecast the use of synthetic rubber air springs, rubber gasoline tanks, rubber-metal bumpers, rubber crash padding, strip rubber door and window seals, and a greater employment of foam rubber cushioning.

He said that 550 rubber parts adding up to an average of 100 pounds go into today's automobile, excluding tires, and that this would be surpassed in future cars. Synthetic rubber, now making up 74% of the rubber parts in autos, will become increasingly important, he added.

This speaker also pointed out that rubber gasoline tanks, being flexible, can be mounted in different locations, permitting the car stylist greater freedom in redesigning the vehicle.

Enjay's Dunkel Speaks on Butyl at Philadelphia Meet

Walter L. Dunkel, Enjay Laboratories, Esso Research & Engineering Co., presented a paper on "Compounding Enjay Butyl for Mechanical Applications" before 141 members and guests of the Philadelphia Rubber Group at the Poor Richard Club, Philadelphia, Pa., April 13.

Butyl rubber, with its high gas impermeability and its heat, ozone, abrasion, flexing, chemical, and weathering resistance, is now becoming available to mechanical goods manufacturers. As with other polymers, specific applications dictate the manner in which the rubber should be compounded.

For maximum ozone resistance, Dr. Dunkel suggested the following: as high a cure state as possible; the use of the lowest unsaturated grades of the polymer, such as Enjay Butyl 035 and 150; the keeping of filler and plasticizer levels at the minimum consistent with other properties; the avoidance of contamination with elastomers of higher saturation; and the obtaining of higher sulfur levels.

An almost antithetical approach should be taken when compounding for maximum heat resistance, the Enjay researcher continued. Polymers of the highest unsaturation, such as Enjay Butyl 325, should be selected. A relatively high black loading is also beneficial, with MAF blacks best in sulfur cured systems, and MT and FT blacks best in quinoid cured compounds. Higher loadings of zinc oxide are almost mandatory.

Factors affecting the chemical or acid resistance of butyl vulcanizates were said to be similar to those regarding ozone resistance. Better abrasion resistance can be obtained by compounding a dynamically soft vulcanizate. Where gas impermeability is a predominant feature, high loadings of furnace blacks and mica fillers will obtain the best results.

Secretary-Treasurer Richard A. Garrett reported the Group's membership at the new high of 545.

C-S Teacher Scholarships

Columbia-Southern Chemical Corp., Pittsburgh, Pa., will begin a program to encourage high school teachers in the Natrium, W. Va., area to acquire advanced education in their fields. The firm recently opened its new research and development center at Natrium.

The program will make available summer fellowships toward advanced degrees for the teachers of chemistry, physics, and mathematics at Magnolia High School, New Martinsville, W. Va., which is attended by many children of employes at the firm's Natrium plant.

According to E. T. Asplundh, president of Columbia-Southern, each award will amount to $500 plus tuition at an accredited institution of the teacher's choice. In order to give candidates the opportunity to complete requirements for their master's degrees, this award will be made for three successive summer terms, if necessary.

Dow-Corning and Fiberglas Present Films at Ontario

The showing of two technical motion pictures highlighted the April 11 meeting of the Ontario Rubber Section, CIC, at the Pickfair Restaurant, Toronto, Ont., Canada. More than 100 members and guests were present.

The films were "The Magic Marble," supplied by Fiberglas Co. of Canada, whose representative, James James, provided the running commentary on fiber glass molding techniques; and "Rubber from Rock," concerning Dow-Corning silicone rubber, which was discussed by Robert White, Dow-Corning of Canada, Ltd. W. H. Bechtel, Kaufman Rubber, Ltd., chairman of the Ontario Section, introduced the speakers and their films.

Nominating Committee Chairman W. J. Nichol, Dunlop Canada, Ltd., presented the following slate of officers for the 1956-57 term: chairman, G. Grushcow, Dayton Rubber Co. (Canada), Ltd.; vice chairman, Wray Cline, Canadian General-Tower, Ltd.; secretary, C. M. Croakman, Columbian Carbon of Canada, Ltd.; and treasurer, R. Tartaglia, B. F. Goodrich Canada, Ltd.

Eugene Skarvenko, Firestone Tire & Rubber Co. of Canada, Ltd.; Bruce Williams, Dunlop; and Ross Smith, Dominion Tire, Ltd., were nominated for Hamilton, Toronto, and Kitchener district representatives, respectively, with Des Seymour, Polymer Corp., Ltd., as representative at large.

The golf committee will consist of Lloyd Lomas, St. Lawrence Chemical Co., Ltd.; and Arthur Luscombe, W. C. Hardesty, Ltd.

Electrostatic Air Cleaner

An improved version of its self-charging, electrostatic air cleaner for heating, ventilating, and air conditioning systems has been placed on the market by The Goodyear Tire & Rubber Co., Akron, O.

Called Heavy Duty Pliotron, the new air cleaner is constructed in three sections; each unit consists of electrostatic plastic materials. The intake side is a screen of vinylidene chloride, and the outlet side is made of a plastic-bonded, glass-fiber mat. Sandwiched between the outer layers is shredded polyethylene film.

According to the company, the improved electrostatic air cleaner was developed to overcome problems in applications where dust concentration is unusually high, where large particles such as chaff, straw, and insects impinge on filter surfaces, and where effective single-pass filtration is required.

Electrostatic filters hold atmospheric dust and other types of airborne particles magnetically, and they can be cleaned by immersion in warm water, Goodyear says. The static charge runs off in the water, releasing the captured materials.

"Heavy Duty Pliotron," folder S-5161, a publication describing the new equipment, may be obtained from the Goodyear company.

Credit, Stock-Car Racing Topics at Tlargi Meeting

The code of ethics of the credit profession based on "Man's Confidence in Man" has made possible the evolution of today's highly developed industrial institutions and trade patterns, R. D. Roberts, Union Oil Co. of California, told 300 members and guests of The Los Angeles Rubber Group, Inc., meeting at the Hotel Statler, Los Angeles, Calif., April 3.

Reading an address, "Speaking of Credit," written by Reese H. Taylor, president of his company, Mr. Roberts, who is credit manager, said that the credit policy formulated by the management of a firm must aim toward procedures that will facilitate distribution and increase profitable sales volume, harmonize with the operations of other departments, create an affirmative attitude, and be flexible enough to meet unusual situations.

"The most constructive area of activity for the credit manager is in the cultivation of marginal accounts, where the basic ingredients of character and capacity are present," he declared. "A risk based on facts and knowledge of an account is vastly different from blind chance."

Guest speaker at the dinner-meeting was Leonard Firestone, The Firestone Tire & Rubber Co., who congratulated Tlargi for its positive approach to the problem of giving technical training to local members of the rubber industry and for its achievement in establishing the Tlargi Rubber Technology Foundation.

Also addressing the group was Peter De Paolo, Ford Motor Co., who spoke on stock-car racing. He attributed the popularity of this sport to the spectator's identification of his own car with a similar make in the event.

New Pine Gum Chemicals

Two new chemical products derived from pine gum are now commercially available for industrial use, it has been revealed by the United States Department of Agriculture, Washington, D. C., whose scientists researched their development at its Olustee, Fla., naval stores station.

The first new product is pinane hydroperoxide (PHP), a catalyst for cold rubber production, with secondary applications in the manufacture of certain plastics. It is being made in limited quantities by American Cyanamid Co., New York, N. Y.

The second is maleopimaric acid, now being used by the photographic industry, and the first industrial chemical to be made directly from pine gum. It is said to have additional applications in the paper coating and printing ink industries, and in others requiring a plasticizer, emulsifier, or resin. The distillation products division of Eastman Kodak Co., Rochester, N. Y., is making the material.

According to USDA, pinane hydroperoxide is made from turpentine in a simple two-stage process. The turpentine is first hydrogenated and then oxidized with air or oxygen to form the peroxide. Ordinary low-pressure hydrogenation equipment can be employed.

NEWS of the MONTH

Washington Report and National News Summary

. . . A Washington study on butadiene production and demand made earlier this year and a stand-pat recommendation resulting from it are now obsolete. The Defense Department has asked for a new survey.

. . . The government's alcohol butadiene plant in Louisville, Ky., now being offered for sale, is apparently of interest not only to Publicker Industries, Inc., but also to Union Carbide & Carbon Corp.

. . . The report of the Office of Defense Mobilization to President Eisenhower suggests that both natural and synthetic rubbers will share in the expanding domestic and world demand for new rubber. Estimated synthetic production will exceed consumption in the U. S. A. by 1957 and may mean larger synthetic rubber exports.

. . . Commerce Department reports figures to confirm 1955 as record production and sales year for the rubber industry. The 1956 outlook is for another year of high level activity, possibly slightly less than in 1955.

. . . Advance reports from the 1954 Census of Manufactures emphasize the increased man-hour productivity in the tire and tube industry. Reclaimed rubber shipments increased 124% over 1947 in dollar value.

Washington Report

Butadiene Supply Being Resurveyed; Request Due Possibly to Higher Octane Auto Engines

The Pentagon has submitted a new set of requirements to the Interior Department which has brought about another good look at the inter-relation among butadiene, butylene, butane, alkylates, and high-octane aviation gasoline, from the standpoint of production capacity this country must have in the event of a war.

During the last two conflicts involving the U.S.A.—World War II and Korea—the government found itself in short supply of butadiene, a key ingredient in both synthetic rubber and alkylates used in the manufacture of high-octane gasolines. Since Korea, however, three key government agencies have kept close tabs on butadiene-producing facilities, ready to step in and encourage increased capacity if and when such capacity threatens to fall short of mobilization needs.

Butadiene—Strategic Material

The agencies involved in this three-cornered surveillance are the Defense and Interior departments and the Office of Defense Mobilization. The last-named, headed by conservative, able Arthur S. Flemming, controls the form and the amount of government aid extended to industry for capacity build-ups. Its principal tool is a Certificate of Necessity for accelerated amortization, which authorizes the builder of a production facility to depreciate a given percentage of construction costs over a short term, for federal tax purposes. In other words, the builder can write off his construction expenses in the early period of the plant's operation when the need of operating capital is usually greatest.

Under the rapid tax write-off program, ODM established an expansion goal for butadiene facilities, but the goal's deadline expired at the first of this year. Although it has never been closed officially, Dr. Flemming was on the verge of closing it when the military came up with a "wait, let's take another look" request.

Principal reason for the restudy is a new and higher estimated military demand for petroleum alkylate, a "cousin" of butadiene since both can be manufactured from refinery butylenes. A sudden, strong demand for one can cause a serious shortage in the other. As one government official put it:

"You have a rather fluid sponge, and if you push in one direction you have to give in another. There is a very close relation of the whole refinery balance."

New Demand Picture

While the Defense-Interior-ODM officials working on the problem jealously guard the reason for or size of the new estimates, it is generally agreed among observers here that a significant factor is the trend toward higher compression automobile engines fueled by higher-octane gasolines.

Of course, a stable civilian demand for high-octane gasolines would work against a program of government aid because industry would not hesitate to increase production of an item with a ready market. The military, however, must look at it this way: If the auto manufacturers are retooling for bigger and bigger civilian engines, then the military vehicles of the future will have to have bigger engines. On mobilization day the Pentagon will have to accept the power plants Detroit is in a position to produce quickly. And, of course, the high-octane gasolines burned by these engines will require more alkylate.

Supply Resurvey

The new study now under way by Interior's Oil & Gas Division follows quickly on the heels of a survey completed earlier this year which found no

need of continuing rapid tax write-off aid on butadiene. This stand-pat survey, which was withdrawn before ODM could act on it, reported specification-grade butadiene capacity at 828,000 short tons annually as of January 1, 1956. Announced expansion in the industry will boost capacity another 111,000 tons by the end of the year, and plans not yet completely firmed up indicate a further rise of 168,000 tons by the end of the first quarter of 1957.

Interior also reported that the bulk of the overall increase—279,000 tons—would use butane, rather than butylenes, as a starting material. Thus the chances of a synthetic rubber squeeze on mobilization day did not appear to be great, even if some butylenes were diverted to produce alkylate. Neither, the government decided, was there any likelihood of a further tightening of the butadiene supply for expanding GR-S type synthetic rubber production. Despite an expected boost in GR-S type rubber production from 907,900 long tons annually to more than 1.3 million tons by late 1957, Interior felt that butadiene output would keep abreast of demand, for the next two years at least.

This picture painted by Interior, however, was knocked askew when Defense came up with its new requirements. The expansion goal which expired five months ago may yet be reopened and revised upward to promote new butadiene capacity, particularly for plants using butane as a starting material.

Meanwhile ODM has pending applications for rapid tax write-off on more than enough production to meet the goal which expired January 1. These applicants will get first crack at government incentives if the butadiene goal is increased.

Publicker, Union Carbide Bid on Louisville Plant

The government got a mildly surprising response last month to its offer to sell or long-term lease the last of its synthetic rubber plants—the 90,000-ton capacity, alcohol-butadiene plant at Louisville, Ky. While it was no secret that Publicker Industries, Inc., of Philadelphia, would come through with alternative purchase or lease bids, the Rubber Producing Facilities Disposal Commission heard from a "sleeper" as well—Union Carbide & Carbon Corp., New York.

When Congress rushed through a bill to authorize disposal of the Louisville plant, in March, only Publicker showed up at the hearings on Capitol Hill. Sen. Homer Capehart (Rep., Ind.), an influential member of the Senate Banking Committee, commented at that time: "It looks to me like we are doing business with you [Publicker], and you alone."

The protest by a Publicker official to this statement was not seriously heeded, but turned out to be well justified when Union Carbide responded to the Disposal Commission's bid invitation.

Publicker and Union Carbide had something in common beside their side-by-side bids on Louisville—each has had operating experience at the plant. Publicker is running the installation now at one-third speed under a three-year lease which expires in April, 1958; Union Carbide operated the plant under government contract until it was temporarily placed on standby basis several years ago.

A major difference in the two bids was Publicker's willingness to enter into a long-term (up to 15 years) rental in the event it could not get together with the Disposal Commission on a mutually acceptable sale price. This alternative offer of Publicker was particularly significant in the light of a Disposal Commission prediction, earlier in the year, that "the possibility of a satisfactory sale (was) highly remote."

Publicker went a step further to bid on the vital catalyst-manufacturing equipment in government standby on the grounds of Davison Chemical Co. in Baltimore. Davison, a division of W. R. Grace Co., also responded to the Disposal Commission's invitation on the Baltimore equipment. Like Publicker in the case of the Louisville plant, Davison offered to buy or lease the equipment; Publicker submitted only a purchase bid.

The only machinery of its kind in the country, it produces a catalyst essential to production of alcohol butadiene. Stocks of the catalyst were estimated by Publicker in March as sufficient to supply Louisville through the end of 1956. Before this backlog runs out, the equipment will have to be reactivated to prevent a slowdown or shutdown at the Kentucky plant. In any event, the new operator is expected to leave the machinery in its present location because the cost of moving it is believed to be more than its actual value.

ODM Report Sees Natural, Synthetic Share New Uses; Increased Synthetic Exports from 1957 Predicted

A six-agency committee appointed to study the nation's rubber position as the end of the synthetic disposal program reported to President Eisenhower last month that natural rubber will continue to share in the growing market despite expanding synthetic capacity.

Report Required by 1953 Law

The long-awaited report was submitted by a special committee appointed by Defense Mobilization Director Flemming and made up of officials from six government agencies—Commerce, Defense, Interior, and the Treasury departments, the National Science Foundation, and the Rubber Producing Facilities Disposal Commission. The group was called together by Dr. Flemming under a Congressional mandate of the Rubber Producing Facilities Act of 1953:

"At the expiration of one year after the transfer period [24 plants were sold to private interests a year ago], or as soon thereafter as the Congress is in session, the president shall report to the Congress concerning the nation's rubber requirements and resources, and the need, if any, for further research by the government relative to the production or use of synthetic rubber and its component materials."

1.7-Million-Ton 1960 Use

The group's findings, submitted to Dr. Flemming who, in turn, passed them on to the President, were generally optimistic of natural rubber's place in the expanding domestic market. Despite its prediction that synthetic rubber capacity would reach 1.7-million tons annually two years before total demand reached that figure, the committee felt that natural producers would hold their share of the market by increasing planting, developing more efficient recovery methods, and exerting greater pressure as to competitive price.

Highlights of the report included:

Of total U. S. consumption about 60% is synthetic, the rest natural rubber, with the latter running at about the prewar World War II level.

Synthetic rubber capacity at end-1955 was 1,250,000 tons. By the end of 1957 or early 1958, capacity should increase by about one-third, to 1.7-million. Of this, 1.44-million tons will be butadiene-styrene rubber, SBR; the rest, synthetic rubber of other types.

Demand for all types of new rubber will not reach the 1.7-million figure until two years later—1960. (Last year's record consumption was 1.5-million tons.)

The military stockpile—about 1.2-million tons of natural—is adequate to take care of civilian and essential military needs for an extended period. All mobilization needs can be met by the stockpile, plus anticipated output of the present synthetic plants. Besides, synthetic polyisoprene now produced in pilot-plant quantities may soon be complete substitute for natural rubber.

A synthetic-rubber balance will be maintained by increasing synthetic exports and less-than-capacity operation of the synthetic facilities. Other factors in this picture include (1) the natural rubber holdings of major U.S.A. firms; and (2) the heavy foreign demand for natural rubber which is expected to close the price gap and make U.S.A. synthetic rubber a bigger factor in foreign consumption.

The National Science Foundation position favoring more government spending for basic research on synthetic elastomers and less on applied rubber research specifically, was endorsed by the committee. The group also backed up the NSF-recommended sale of the Akron laboratories.

Transfer of the synthetic industry to private firms puts the U.S.A. in a self-sufficient position, militarily, for the first time in history.

Pricing Report Next

As RUBBER WORLD went to press, President Eisenhower was studying the ODM report for quick submission to Congress. The White House was also looking for a report from the Attorney General on pricing and other competitive conditions in the synthetic rubber producing industry. Congressional reaction to both was expected to be over-shadowed by the general rush toward enacting key legislation holding up early adjournment in a presidential election year.

Tire Tax Collection Changes; Industry Continues Protests

Two Washington trade associations representing different segments of the rubber industry continued last month in a behind-the-scenes struggle over Congressional attempts to strengthen and streamline administration of the federal excise tax laws. The National Tire Dealers & Retreaders Association held a slight lead over the Rubber Manufacturers Association, Inc., on a proposed change in collection of the 5¢-per-pound tax on tires and the 9¢-per-pound tax on inner tubes.

Excise Collection Change

The tire manufacturers are fighting a House subcommittee recommendation designed to remove a "competitive discrimination against independent tire dealers." Under the law as it reads now, tire and inner tube excises are collected at the time of sale by the manufacturer, producer, or importer. The Forand subcommittee of the House Ways & Means Committee, however, sized up the need of a change this way, in reporting on six months of investigation on administration of all excise taxes:

"In the case of tire manufacturers maintaining their own retail outlets," the subcommittee reported on the timing of collection, "this means that no tax is imposed until the manufacturer makes a sale to the consumer. This means that the inventory held by the manufacturer in the retail store is not tax paid.

"On the other hand, an independent tire dealer, since the sale by the manufacturer occurred prior to his acquisition of the tires and tubes, can have only tax-paid inventory. This requires relatively larger working capital on the part of the independent dealer and also means higher insurance costs for his inventory. Similar situations exist in the case of wholesale outlets. Here also the manufacturer-owned wholesale outlet can operate with smaller working capital and with less insurance charges because of its tax-free inventory.

"To remove this competitive discrimination against independent tire dealers, the subcommittee recommends that where a manufacturer makes some of his sales through his own wholesale or retail stores, the tire and tube taxes with respect to all of his sales should be collected from him at the time the tires and tubes initially are withdrawn from the manufacturing plant or from a warehouse within a 20-mile radius of the manufacturing plant.

"It is estimated that this recommendation will result in a revenue increase of about $1 million in the year in which it is adopted."

Extra Tax on Tubeless?

The tire manufacturers were also bristling at another Forand subcommittee recommendation that an additional 1¢-per-pound impost be levied on tubeless tires. Strong support of the manufacturers for the Administration's highway bill took into account an increase in that legislation in the excise on this rubber product. If the Forand suggestion were to be adopted, the manufacturers argue, tubeless tires would have to bear a double tax increase. Despite rubber producer protests, the Forand unit filed this recommendation with its parent committee:

"It is understood that within a period of three to five years, inner tubes for tires will no longer be manufactured and that tubeless tires will fully displace the use of inner tubes. The present tax on tubeless tires is the same as that on tires requiring inner tubes, namely, 5¢ a pound. The conversion to tubeless tires will, therefore, probably result in a loss of revenue from inner tubes although this loss will be partially offset by the fact that tubeless tires tend to weigh more than tires requiring inner tubes.

"To offset this loss the subcommittee recommends that a 1¢ additional tax be imposed in the case of tubeless tires.

"This increase will somewhat more than offset the revenue which the government will otherwise lose from the disappearance of the revenue on inner tubes. Based upon the present use of tubeless tires, a 1¢ additional tax on tubeless tires will increase revenues by about $6.6 million a year."

Tire manufacturers took heart from this double blow in the fact that the Forand recommendations had a long way to go before becoming part of the law. With only three months of the Congressional session left, the recommendations were subject to modification, disapproval, or approval by the House Ways & Means Committee, the House itself, the Senate Finance Committee, and the Senate itself. At any one of these stages the recommendations could be knocked out.

Further 1954 Census of Manufactures Advance Reports; Tires and Inner Tubes and Reclaimed Rubber Industries

The first advance report of the 1954 Census of Manufactures of the Bureau of Census, U. S. Department of Commerce, on the footwear industry became available in March.[1] In April advance reports on the tires and inner tubes industry and the reclaimed rubber industry were received.

It is unfortunate that the first Census of Manufactures since 1947 was made in 1954 since the years 1953 and 1955 provided better evidence of the extent of growth of the various branches of the rub-

[1] See our Apr., 1956, issue, p. 98.

Table 1.—GENERAL STATISTICS FOR THE TIRES AND INNER TUBES INDUSTRY IN THE UNITED STATES: 1954 AND 1947

(Standard Industrial Classification Code 3011)

Item	Unit of measure	1954	1947	Percent change 1947-1954
Establishments	Number	49	57	-14
All employees:				
Number	Thousands	92.7	115.7	-20
Payroll	Million dollars	441.6	390.8	+13
Production workers:				
Number	Thousands	74.0	93.9	-21
Man-hours	Millions	138.0	185.4	-26
Wages	Million dollars	334.1	311.3	+7
Value added by manufacture[1]	....do	844.5	650.2	+30
Cost of materials, fuel, electricity, and contract work[2]	....do	997.2	944.2	+6
Value of shipments[3]	....do	1,841.7	1,547.0	+19
Capital expenditures, new	....do	67.4	54.9	+23

[1] For 1954, value of shipments less cost of materials, supplies, fuel, electric energy, and contract work. For 1947, estimated value of production was used in the calculation, in place of value of shipments. If the 1947 value added figure had been calculated on the basis of value of shipments (rather than estimated value of production, as was the case), the 1947 "value added by manufacture" for this industry would have been $602.8 million.

[2] Excludes cost of products bought and resold in the same condition.

[3] Includes, for all establishments classified in this industry, not only (a) their value of products "primary" to the industry, but also (b) their value of "secondary" products, which are primary to other industries, and (c) their "miscellaneous receipts" for repair work, sales of scrap, installation of own products, etc. Excludes sales of products bought and resold in the same condition.

Table 2.—GENERAL STATISTICS FOR THE TIRES AND INNER TUBES INDUSTRY (S.I.C. CODE 3011) BY REGIONS AND STATES: 1954 AND 1947

Region and State[1]	1954									1947	
	Establishments, number	All employees		Production workers			Value added by manufacture[2]	Cost of materials, etc.[3]	Value of shipments[4]	Capital expenditures, new	All employees, number	Value added by manufacture[2]
		Number	Payroll ($1,000)	Number	Man-hours (1,000)	Wages ($1,000)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)
United States, total[5]	49	92,747	441,607	73,976	137,980	334,104	844,545	997,186	1,841,732	67,429	115,657	650,165
Northeast	10	11,604	57,654	9,472	19,338	45,402	136,260	147,842	284,102	16,924	17,461	117,362
Pennsylvania	6	5,412	25,614	4,596	9,092	21,122	72,117	79,128	151,245	9,464	8,290	55,236
North Central	20	56,613	267,378	44,016	77,443	193,584	419,749	526,239	945,989	33,399	71,771	355,898
Ohio	12	39,203	180,185	29,769	49,986	124,599	249,197	293,410	542,608	18,425	49,709	233,364
South	11	14,373	67,050	12,137	24,484	55,093	190,679	208,440	399,119	7,951	15,846	115,987
West	8	10,157	49,524	8,351	16,715	40,024	97,857	114,664	212,521	9,155	10,579	60,918

[1]Each producing State not shown separately has been withheld either (a) to avoid disclosing figures for individual companies; or (b) because the State had less than 1,000 employees in the industry. (Additional publishable detail will appear in the final Census bulletin for this industry.)

[2]For 1954, value of shipments less cost of materials, supplies, fuel, electric energy, and contract work. For 1947, estimated value of production was used in the calculation, in place of value of shipments. If the 1947 value added figure had been calculated on the basis of value of shipments (rather than estimated value of production, as was the case), the 1947 "value added by manufacture" for this industry would have been $602.8 million.

[3]Includes cost of materials, fuel, electricity, and contract work, excludes cost of products bought and resold in the same condition.

[4]Includes, for all establishments classified in this indutry, not only (a) their value of products "primary" to the industry, but also (b) their value of "secondary" products, which are primary to other industries, and (c) their "miscellaneous receipts" for repair work, sales of scrap, installation or own products, etc. Excludes sales of products bought and resold in the same condition.

[5]Sum of regional figures may not equal U. S. total, due to inaepenaent rounding.

Table 3.--QUANTITY AND VALUE OF TIRES AND INNER TUBES SHIPPED BY ALL PRODUCERS IN THE UNITED STATES: 1954 AND 1947

(Includes quantity and value of those products reported both by establishments classified in the Tires and Inner Tubes Industry and by those establishments making these items as "secondary" products in other industries)

Product code	Product	Unit of quantity	Total shipments including interplant transfers			
			1954		1947	
			Quantity	Value ($1,000)	Quantity	Value ($1,000)
3011	Tires and inner tubes, total	...	...	[1]1,621,917	...	1,463,357
	Pneumatic tires (casings):					
3011011	Passenger car	Thousand tires	76,712	853,636	75.787	670,039
3011012	Motorcycle	....do	67	609	203	1,365
3011013	Truck and bus (including off-the-road)	....do	12,552	520,168	17,172	536,708
3011014	Airplane	....do	369	23,557	155	5,367
3011015	Tractor and implement	....do	2,988	68,431	4,833	78,598
3011016	Industrial	....do	1,147	5,878	1,237	5,160
3011017	Bicycle casings and single tube tires	....do	7,311	7,790	9,417	9,456
	Inner Tubes:					
3011021	Passenger car	Thousand tubes	52,090	74,118	65,878	90,608
3011022	Motorcycle	....do	64	87	([2])	([2])
3011023	Truck and bus (including off-the-road)	....do	9,208	31,328	14,066	41,776
3011024	Airplane	....do	257	2,125	94	467
3011025	Tractor and implement	....do	2,589	7,279	3,894	10,179
3011026	Industrial	....do	1,325	1,295	1,193	1,210
3011027	Bicycle	....do	7,505	4,129	11,351	[2]5,761
	Solid tires:					
3011031	Pressed on industrial and highway	Thousand tires	314	5,255	281	3,525
3011033	Cured on industrial (2.00" or larger which are cured on a wheel)	....do	671	1,801	850	2,003
3011035	Bogie, idler and support rollers	Thousand units	286	4,986	([3])	([3])
3011037	Semi-pneumatic	Thousand tires	28,904	8,743	[4]498	[4]602
3011039	Other solid	....do	2,422	702	[4]944	[4]533

[1]Of this total value, 99 percent was shipped in 1954 by plants classified in the Tires and Inner Tubes Industry; the remainder was shipped as "secondary products" by plants classified in other industries.

[2]Included with "bicycle inner tubes".

[3]Included with "other solid tubes".

[4]Excludes data for tires less than 2.00 inch which in 1947 were reported with tiring and classified as primary to Industry 3099.

ber goods manufacturing industry. Such a development could not be foreseen, however, and it is presumably not possible to change from one year to another very easily.

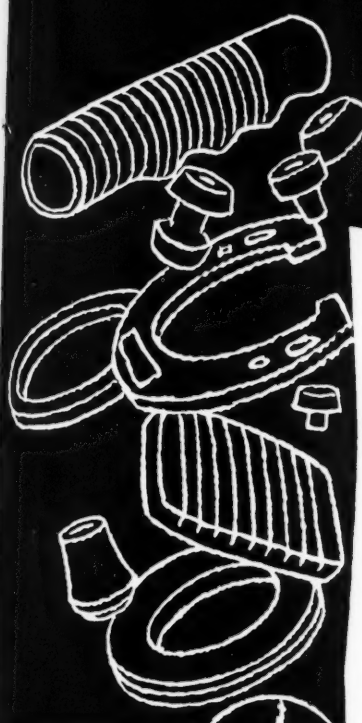
These advance reports are available from the Bureau of Census, Washington 25, D. C., and Commerce Department Field Offices at 10¢ each. The Rubber Footwear Industry is Series MC-30.1, the Reclaimed Rubber Industry is Series MC-30.2, and the Tires and Inner Tubes Series MC-30.3.

Tires and Tubes

During 1954, manufacturers of tires and tubes shipped products valued at $1,842-million, an increase of 19% over the 1947 figure. Average employment in the in-

SHARPLES ETHYLAC®

for Improved Mold Flow and Fewer "Seconds"



The delayed action of Sharples ETHYLAC cures assures better mold flow, with complete and accurate molding. This results in a sharp decrease in "seconds".

When ETHYLAC is used in fast-curing molded goods, fewer rejects are encountered and quality of the finished product is materially improved.

•

Technical information and samples are available on request.

SHARPLES CHEMICALS Division

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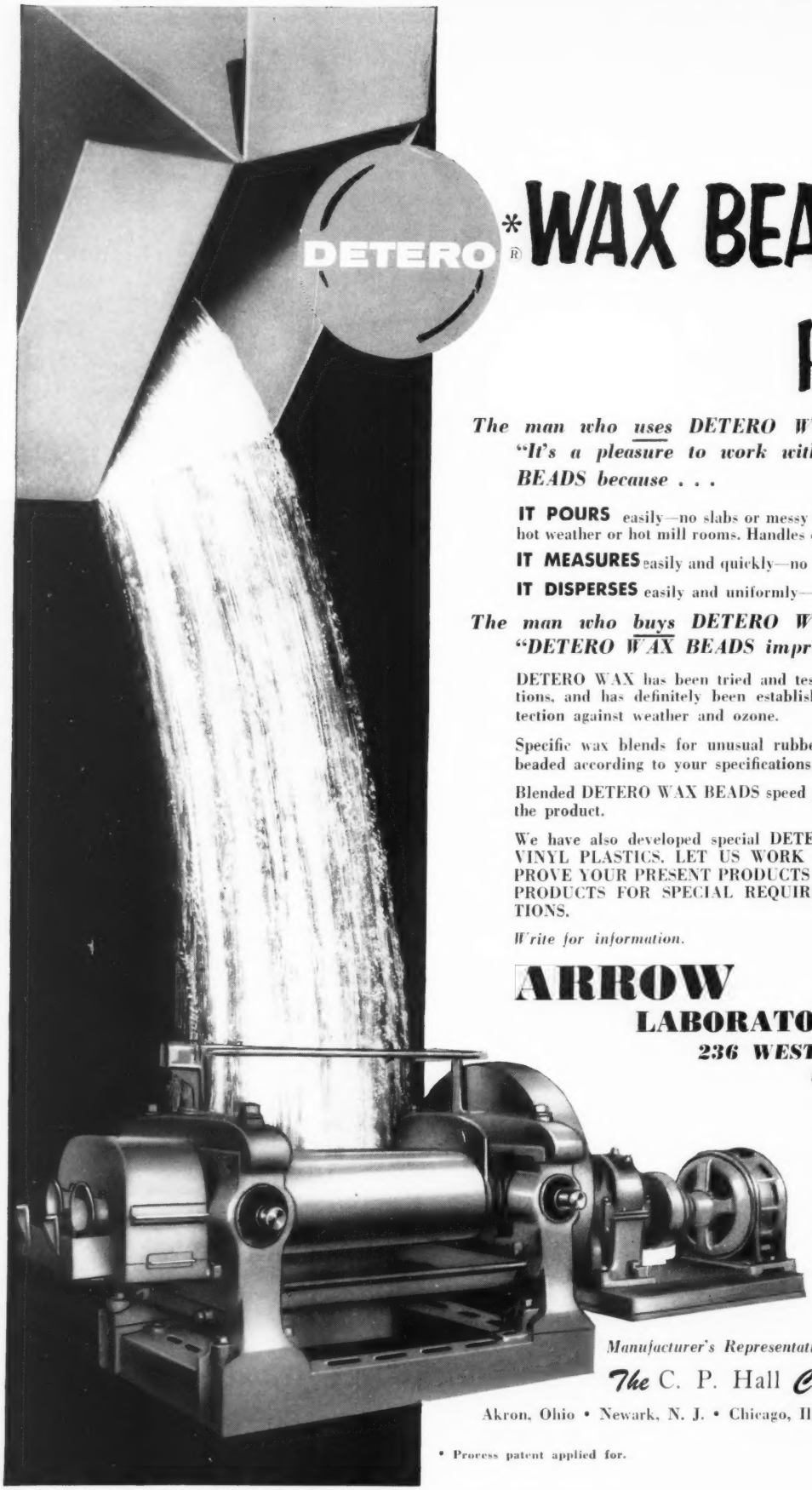
Executive Office: Philadelphia, Pa.

Martin, Hoyt & Milne Inc., San Francisco • Los Angeles • Seattle • Portland

Shawinigan Chemicals, Ltd., Montreal • Toronto

Airco Company International, New York



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DETERO WAX has been tried and tested in rubber formulations, and has definitely been established as a superior protection against weather and ozone.

Specific wax blends for unusual rubber formulations can be beaded according to your specifications.

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We have also developed special DETERO WAX BEADS for VINYL PLASTICS. LET US WORK WITH YOU—TO IMPROVE YOUR PRESENT PRODUCTS or to DEVELOP NEW PRODUCTS FOR SPECIAL REQUIREMENTS OR CONDITIONS.

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The C. P. Hall ***Company***

Akron, Ohio • Newark, N. J. • Chicago, Ill. • Los Angeles, Cal.

* Process patent applied for.

Table 1.—GENERAL STATISTICS FOR THE RECLAIMED RUBBER INDUSTRY IN THE UNITED STATES: 1954 AND 1947

(Standard Industrial Classification Code 3031)

Item	Unit of measure	1954	1947	Percent change 1947-1954
Establishments	Number	19	15	+27
All employees:				
Number	Thousands	2.9	2.1	+38
Payroll	Million dollars	12.6	6.8	+85
Production workers:				
Number	Thousands	2.4	1.9	+26
Man-hours	Millions	4.6	4.0	+15
Wages	Million dollars	9.6	5.8	+66
Value added by manufacture[1]	....do.	21.9	9.6	+128
Cost of materials, fuel, electricity, and contract work[2]	....do.	16.8	8.0	+110
Value of shipments[3]	....do.	38.7	17.3	+124
Capital expenditures, new	....do.	2.8	2.9	-3

[1]For 1954, value of shipments less cost of materials, supplies, fuel, electric energy, and contract work. For 1947, estimated value of production was used in the calculation, in place of value of shipments. If the 1947 value added figure had been calculated on the basis of value of shipments (rather than estimated value of production, as was the case), the 1947 "value added by manufacture" for this industry would have been $9.3 million.

[2]Excludes cost of products bought and resold in the same condition.

[3]Includes, for all establishments classified in this industry, not only (a) their value of products "primary" to the industry, but also (b) their value of "secondary" products, which are primary to other industries, and(c) their "miscellaneous receipts" for repair work, sales of scrap, installation of own products, etc. Excludes sales of products bought and resold in the same condition.

Table 2.--GENERAL STATISTICS FOR THE RECLAIMED RUBBER INDUSTRY (S.I.C. CODE 3031) BY REGIONS AND STATES: 1954 AND 1947

Region and State[1]	1954										1947	
	Establishments, number	All employees		Production workers			Value added by manufacture[2]	Cost of materials etc.[3]	Value of shipments[4]	Capital expenditures, new	All employees, number	Value added by manufacture[2]
		Number	Payroll ($1,000)	Number	Man-hours (1,000)	Wages ($1,000)	($1,000)	($1,000)	($1,000)	($1,000)		($1,000)
United States, total[5]	19	2,930	12,597	2,441	4,566	9,596	21,872	16,824	38,696	2,834	2,070	9,604
Middle Atlantic	7	983	4,233	809	1,614	3,064	6,367	4,272	10,640	413	(D)	(D)
All other States	12	1,947	8,364	1,632	2,952	6,532	15,505	12,552	28,056	2,421	(D)	(D)
Ohio	7	1,326	5,594	1,127	2,013	4,491	10,556	9,162	19,719	622	(D)	(D)

D Withheld to avoid disclosing figures for individual companies.

[1]Each producing State not shown separately has been withheld either (a) to avoid disclosing figures for individual companies; or (b) because the State had less than 1,000 employees in the industry. (Additional publishable detail will appear in the final Census bulletin for this industry.)

[2]For 1954, value of shipments less cost of materials, supplies, fuel, electric energy, and contract work. For 1947, estimated value of production was used in the calculation, in place of value of shipments. If the 1947 value added figure had been calculated on the basis of value of shipments (rather than estimated value of production, as was the case), the 1947 "value added by manufacture" for this industry would have been $9.3 million.

[3]Includes cost of materials, fuel, electricity, and contract work, excludes cost of products bought and resold in the same condition.

[4]Includes, for all establishments classified in this industry, not only (a) their value of products "primary" to the industry, but also (b) their value of "secondary" products, which are primary to other industries, and (c) their "miscellaneous receipts" for repair work, sales of scrap, installation of own products, etc. Excludes sales of products bought and resold in the same condition.

[5]Sum of regional figures may not equal U. S. total, due to independent rounding.

Table 3.—QUANTITY AND VALUE OF RECLAIMED RUBBER SHIPPED BY ALL PRODUCERS IN THE UNITED STATES: 1954 AND 1947

(Includes quantity and value of those products reported both by establishments classified in the Reclaimed Rubber Industry and by those establishments making these items as "secondary" products in other industries.)

Product code	Product description	1954			1947		
		Production for all purposes	Total shipments including interplant transfers		Production for all purposes	Total shipments including interplant transfers	
			Quantity	Value		Quantity	Value
		(1,000 lb.)	(1,000 lb.)	($1,000)	(1,000 lb.)	(1,000 lb.)	($1,000)
3031	Reclaimed rubber, total[1]	582,613	508,948	44,542	635,762	483,681	36,040
3031011	Reclaimed rubber[2]	569,058	501,013	43,734	628,606	480,624	35,931
3031051	Crumb or ground rubber[3]	13,555	7,935	808	7,156	3,057	109

[1]Of the total value of 1954 shipments, 73 percent was shipped by plants classified in the Reclaimed Rubber Industry; the remainder was shipped as "secondary products" by plants classified in other industries. The production data for 1954 and 1947 are directly comparable whereas the 1954 shipments include interplant transfers, which in 1947, were reported by some establishments as produced and consumed. (See Text for additional comment)

[2]Any vulcanized material, except reclaimed residue or "mud" derived from processing or treatment of natural or synthetic (chemical) vulcanized scrap rubber.

[3]Grindings of scrap rubber not devulcanized by the pan or digester process.

dustry, however, has dropped 20% since 1947 to a total of 92.7-thousand employes in 1954. Value added by manufacture amounted to $845-million in 1954, an increase of 30% over the 1947 value; while value of shipments amounted to $1,841.7-million, a 19% increase over the 1947 figure. In Tables 1 and 2, the $1,841.7-million total value of shipments reported by establishments classified in Industry 3011, Tires and Inner Tubes, consisted of $1,839-million manufactured products and about $3-million miscellaneous receipts for contract work, research and development, sales of scrap, etc. The $1,839-million product shipments were accounted for by $1,612-million of tires and inner tubes and other products primary to the industry, and $227-million of products primary to other industries (e.g., mechanical rubber goods, plastics products, etc.) (Table 3.)

More detailed figures for the tire and inner tube industry will appear later in the Census Bulletin, MC-30A, "Rubber Products," which will be published and offered for sale at a later date by the Superintendent of Documents, U. S. Government Printing Office.

Reclaimed Rubber

Manufacturers in the reclaimed rubber industry shipped products valued at $39-million in 1954, an increase of 124% over 1947 shipments. Average employment in this industry increased 38% since 1947 to a total of 2.9 thousand employes in 1954; while value added by manufacture amounted to $22 million, an increase of 128% over the value for 1947.

The value of shipments, as reported by establishments classified in the reclaimed rubber industry, consisted not only of products described as primary to the industry, ($38-million), but also included miscellaneous receipts for contract work ($1-million). The $38-million product shipments were accounted for by $33-million of reclaimed rubber and $5-million of miscellaneous rubber products and reclaimed plastics materials.

The industry's total value of shipments, in Tables 1 and 2, should be clearly distinguished from the total value of primary products of the industry shipped by all producers, which appears in Table 3 and indicates that $45 million of reclaimed rubber products were shipped by all producers. Of this latter total, 73% was shipped by plants classified in the reclaimed rubber industry, while the remainder was shipped as secondary products by plants classified in other industries. In 1947 only 44% of the reclaimed rubber shipped was by plants classified as primary for that industry, but the method of reporting has been changed so that reclaiming activities of tire and tube and other rubber industry branches were reported as if for separate reclaiming establishments.

More detailed figures for this industry, as well as for other branches of the rubber industry, will appear later in Census Bulletin MC-30A, "Rubber Products," when a detailed explanation of such terms as "industry," "establishment," "secondary production," and various statistical terms such as "value added" will be given.

Note: Tires and Tubes Table 1 is on p. 261; Tables 2 and 3 are on p. 262. Reclaim tables are on p. 265.

Commerce Dept. Confirms 1955 Record Production, Sales

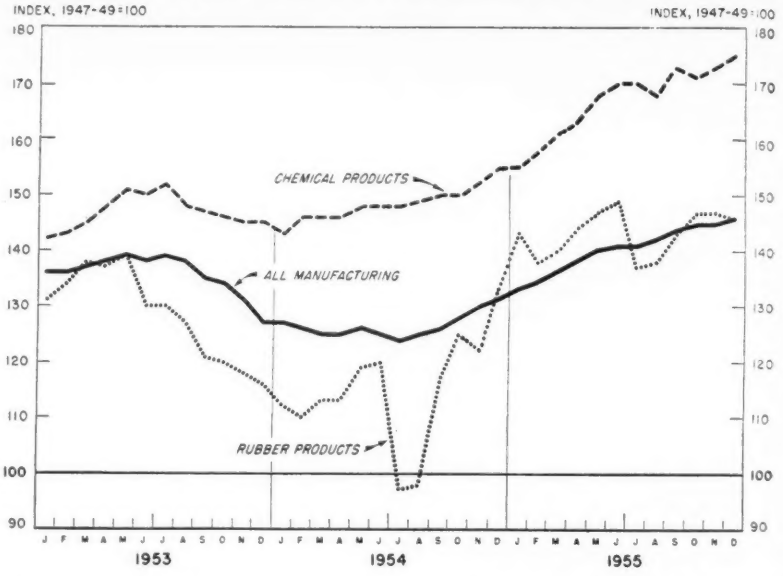


Fig. I. Federal Reserve Board monthly production indices for the chemical products, rubber products, and all manufacturing industries, 1953-1955 (adjusted for seasonal variation)

The United States Department of Commerce, Business & Defense Services Administration in its "Industry Report—Chemical and Rubber" for March, 1956, confirmed previous industry reports of 1955 record production and sales in the chemical products and the rubber products industries. The accompanying charts, Figure 1 for the Federal Reserve Board monthly production indices for 1953-1955, and Figure 2 for the trend of monthly sales for all manufacturing, chemical products, and rubber products industries for the same period, illustrate these facts.

In view of the increasing participation of the rubber products industry in chemical products manufacturing we are including Commerce Department's comments on the chemical products industry as well as the rubber products industry.

Chemical Products

A new chemicals production record was established in December, 1955, with a Federal Reserve Board index of 175 (1947-49=100). The December peak of 175 was greater than 1954's year-end high by 20 index points, a 13% advance.

The 1955 record volume, which resulted in a chemical index for the year of 167, about 13% over production in the preceding year, is attributed generally to the high sustained rate of industrial activity and expenditure combined with rising corporate and individual income, Commerce explained. Although the short-term growth rate in chemicals output has tapered off somewhat in recent months, paralleling a general leveling off in industrial activity, chemical production is being maintained at the highest point in the history of the industry.

Chemical manufacturers' sales established an all-time record in 1955 with volume just topping $23 billion, an 18% increase over the 1954 level. For the first time in history, chemical sales exceeded $2-billion a month in March, April, September, and October, with average monthly sales for the year amounting to $1,919-million.

Chemical sales have tended to level off in recent months. However, the first half of 1955 showed a 17% advance over the volume of the preceding six months, while chemical sales in the last half of 1955 increased over the first half by only 0.6%.

The maintenance of a high and relatively stable volume of output and sales through the first half of the current year is expected, however.

The dollar value of chemical inventories on a seasonally adjusted basis rose almost 2% in December, 1955, to a peak of $3,214-million, the highest point in the history of the industry. This inventory advance has not kept pace with increased sales levels, however, and a comparatively low relation of chemical stocks to sales of 1.64 to 1 at the end of 1955 may indicate some fear of dislocation due to a possible need of liquidation of excessive inventories in the event of reduced sales volume, although current sales levels do not appear to warrant such fears, the Commerce Department concluded.

Rubber Products

The FRB seasonally adjusted index of production in the rubber products industry reached 146 in December, 1955, and averaged 143 for the year. In all but three months of the year the index held above the previous high of 139 registered in May, 1953, and in June, 1955, reached a record 149.

The record 1955 output was helped along by general activity throughout the industry, but the height of the sweep was largely due to extraordinarily high automobile production with its huge demand

for original-equipment tires and other rubber products.

Sales by rubber products manufacturers set a new record of about $5.5-billion in 1955, replacing the previous mark of $5.1-billion posted in 1953. Part of the increase reflected higher wholesale prices for rubber products in 1955. Sales in 1954 amounted to only $4.5-billion.

With new car output expected to be lower in 1956, sales of original-equipment tires may be lower although replacement tire sales may be higher; rubber products output and sales will show a small decline in 1956, according to Commerce Department economists.

At the end of November, 1955, the ratio of the dollar value of inventories to sales (both seasonally adjusted) was 1.94 to 1, compared with 2.01 to 1 at the end of November, 1954, and 1.97 to 1 at the end of December, 1954. At present sales levels, inventories do not appear excessive; but it is anticipated that manufacturers may reduce tire inventories somewhat in 1956, in line with reduced original equipment demand.

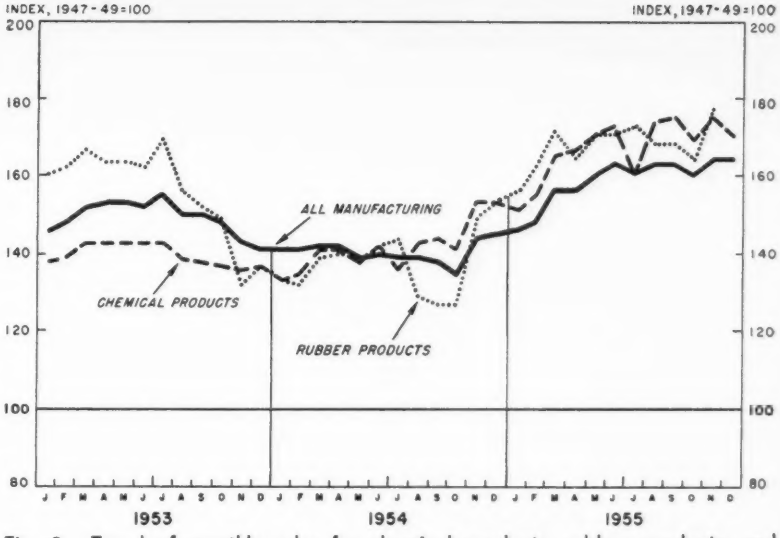


Fig. 2. Trend of monthly sales for chemical products, rubber products, and all manufacturing industries, 1953-1955 (revised figures)

Industry News

Thomas Becomes Chief Executive Officer in Goodyear Management Shuffle; Litchfield Still Board Chairman

P. W. Litchfield, second from left, Goodyear board chairman, congratulates E. J. Thomas, Goodyear president, on his assuming post of chief executive officer. Watching, left to right, are vice president H. L. Hyde and newly named executive vice presidents P. E. H. Leroy, R. S. Wilson, and Russell DeYoung

P. W. Litchfield has yielded his post of chief executive officer of The Goodyear Tire & Rubber Co., Akron, O., to E. J. Thomas, president of the firm. Now serving his fifty-first year as a member of the company's board of directors, Mr. Litchfield will continue as chairman of the board and will serve on various mangement committees. He has been chief executive officer for the past 30 years.

Other top-level management changes were announced by the company. R. S. Wilson, P. E. H. Leroy, and R. DeYoung have been named executive vice presidents in charge of sales; finance and accounting; and production, personnel, research and development, respectively.

The three men will also serve on a newly created policy committee together with Mr. Litchfield, H. L. Hyde, L. E. Spencer, and Mr. Thomas, who will act as chairman.

Mr. Spencer, Victor Holt, Jr., and F. J. Carter were named vice presidents of the the parent company. Mr. Holt was formerly vice president of the subsidiary sales company in charge of tire renewal sales; Mr. Spencer served as assistant to the president; and Mr. Carter was director of personnel.

Also advanced to vice presidencies were C. C. Gibson, manager of original equipment and government sales; and P. K. Coe, manager of the rubber company's Detroit, Mich., office.

Two Goodyear vice presidents have announced their retirements. They are J. M. Linforth, in charge of manufacturers' and government sales; and F. W. Climer, in charge of industrial relations.

Names New Distributors

The Goodyear Tire & Rubber Co., Akron, O., has appointed the following firms as new distributors of its rubber and vinyl flooring products: Georgia Metal Moulding Co., Atlanta, Ga.; Armstein Carpet Co., San Francisco, Calif.; Hill Corp., San Francisco; Empire Distributing Co., Salt Lake City, Utah; and I. J. Saks & Co., Los Angeles, Calif.

March Synthetic Output Sets New Monthly Record

Total Synthetic Rubber	Production	Imports	Exports	Net	Consumption	End of Month Stocks
February	90,488	*906	*11,050	80,344	76,087	146,405
2 Months	184,010	*1,640	*21,678	163,972	154,529	
March*	94,339	*682	*10,403	84,618	78,601	152,422
3 Months*	278,349	*2,322	*32,081	248,590	233,130	
Total Natural Rubber						
February		55,560	850	54,710	50,077	111,278
2 Months		114,363	2,727	111,636	103,447	
March*		57,307	700	56,607	49,534	109,681
3 Months*		171,670	3,427	168,243	152,981	
Total Natural and Synthetic						
February					126,164	257,683
2 Months					257,976	
March*					128,135	262,103
3 Months*					386,111	

*Estimated.

The previous monthly high for synthetic rubber production in the United States in January of this year, 93,552 long tons, was exceeded in March with an output of 94,339 long tons, according to the regular monthly report of the Rubber Manufacturers Association. The consumers of new rubber established a new high relation of synthetic rubber consumed when the ratio of synthetic use to total new rubber use also advanced to 61.34% in March.

Consumption in March of total new rubber was 128,135 long tons, compared to 136,042 tons in March a year ago. Since export was not much different than in recent months, the excess of synthetic rubber was used to build up inventories somewhat.

Natural rubber consumption in March was 49,534 long tons, as compared with 58,758 tons used in March, 1955.

Some of the details of the RMA report of April 23, appear in the table above.

Exports of synthetic rubber in March at 10,403 long tons were actually less than in February when the figure was 11,050 tons, figures worth noting in view of the March production record.

Phillips Petroleum Announces *cis* 1,4 Polybutadiene; Suggested as Economical Alternate for Natural

Phillips Petroleum Co., Bartlesville, Okla., has announced a process for producing *cis* 1,4 polybutadiene in high yields and points out that this new synthetic rubber gives promise of providing an economical alternate for natural rubber in many of its uses.

Heat build-up of the *cis* 1,4 polybutadiene in the Goodrich flexometer is 20° F. below that of standard butadiene-styrene (SBR) cold rubber. The resilience is 10 to 15% better than that of SBR and the freeze point is about −160° F., some 90° better than for SBR. Unlike emulsion polymerized polybutadiene, the new rubber is easily compounded by standard techniques and has an excellent balance of other physical properties, the company says. Infrared studies have confirmed that the material is better than 90% *cis* 1,4 polymer with minor amounts of *trans* 1,4 and 1,2 addition.

A modification of the process produces a *trans* 1,4 polymer which is a high-softening point (greater than 300° F.) resin with many potential uses.

The catalyst systems employed are said to be stereospecific or "directive" in action; in other words, the polybutadiene is mass polymerized.

Akron University Forms Rubber Research Institute

The establishment of an Institute for Rubber Research at the University of Akron, Akron, O., was announced during April by Norman P. Auburn, president of the University. The Institute is an outgrowth of a half-century of teaching and research in rubber chemistry at Akron University which began in 1908 when the late Prof. C. M. Knight introduced the first course in rubber chemistry. The late H. E. Simmons, before assuming the presidency of the University in 1933, was also active in continuing and expanding this work in his capacity as professor and head of the chemistry department.

In 1943, under the impetus of the Government Synthetic Rubber Program, a more substantial research program was started under the direction of G. Stafford Whitby, who also became the first professor of rubber chemistry at the University. Since 1953, and in keeping with the rapid developments in synthetic elastomers and polymers, there has been a continued expansion in rubber and polymer research under the direction of Maurice Morton, who became the first professor of polymer chemistry and now becomes the director of the Institute.

Akron University's Rubber Research Institute is engaged in basic research in the field of natural and synthetic polymers and has as its main purpose the advancement of knowledge in this vital area of science, with the concomitant aim of providing a training ground for future scientists in this field. The work is financed by grants from foundations, government agencies, and industrial concerns.

Projects being worked on at the Institute at the present time include an investigation of extent of branching in addition polymerization for the U. S. Air Force, an investigation of the mechanism of degradation of condensation polymers for the U. S. Army Signal Corps, and work on the synthesis of new types of silicone rubbers for the Army Quartermaster Corps.

The facilities of the Institute consist of both chemical and physical laboratories, all of which are located in Knight Chemical Laboratory on the campus. In addition to the usual equipment found in laboratories devoted to polymer chemistry, the University is fortunate in possessing the necessary rubber processing and testing equipment required for the evaluation of the physical behavior of elastomers.

Present staff of the Institute consists of about 20 full-time technical personnel, including research chemists and physicists, and technical assistants. Besides, several holders of graduate fellowships, sponsored by industry, are also engaged in the research projects being carried out by the Institute, and several senior undergraduates are given an opportunity to assist in this research work, as part of their training.

This summer the Institute and the Department of Chemistry of the University will offer a special intensive course on elastomers for a group of 25 scientists and engineers employed in industry and business. The course will be given June 11-16, at Knight Hall on the University campus, and will consist of lectures and laboratory work under the direction of Dr. Morton, with Howard Stephens as laboratory instructor.

Lecturers in addition to Dr. Morton, comprise Dr. Whitby; James P. Barry and Alan G. Thomas, both of the British Rubber Producers Research Association; and G. Russell Taylor, Westinghouse Electric Corp.

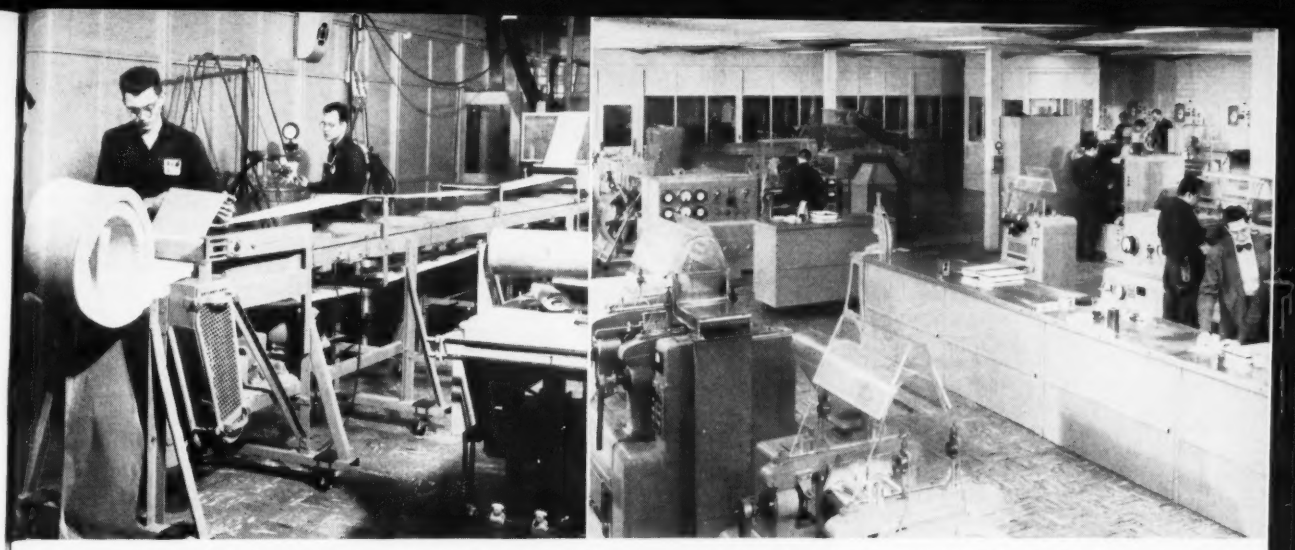
Registration for this course should be accomplished by May. The cost will be $150.

Industrial Rayon Sales High

The textile and tire rayon divisions of Industrial Rayon Corp., Cleveland, O., are operating at more than 98% of capacity, Hayden B. Kline, president, told shareholders at the company's annual meeting, March 28.

Sales continued at a high level during the first quarter of 1956 and are expected to approximate $20,000,000, Mr. Kline said. Sales in the fourth quarter of 1955, a record year for the company, were almost $21,000,000.

Equipment for an initial capacity of about one million pounds a year of high-tenacity nylon filament yarn for tires and industrial uses is being installed at the firm's Covington, Va., nylon plant, the rayon executive revealed. Production will start in July.



Experimental unit for the continuous production of urethane foams, *left*, and a portion of the ultra-modern mill room, *right*, at the new Du Pont Elastomers Division Laboratory

Du Pont Elastomers Division Opens New Wilmington Laboratory

The Elastomers Division of E. I. du Pont de Nemours & Co., Inc., officially opened its new $2.8 million product development and technical service laboratory at Chestnut Run, near Wilmington, Del., on April 18. This new installation is the latest segment of Du Pont's new technical sales service center at that location. Similar laboratories for plastics and textiles are already in operation at Chestnut Run.

The new Elastomers Laboratory contains about 70,000 square feet of floor space and is probably the largest and most complete unit of its kind ever assembled. This laboratory was designed primarily to provide technical service on neoprene and "Hypalon" synthetic rubbers, "Hylene" organic isocyanates, and rubber chemicals, and many operations in rubber goods manufacture can be duplicated here. In the past these activities have been conducted at the Rubber Laboratory in Deepwater Point, N. J., one of the oldest industrial laboratories in the rubber chemicals field (since 1922)

E. R. Bridgwater heads up the Elastomers Division as director of sales, and O. M. Hayden is assistant director of sales. C. A. Bartle is sales manager for rubber chemicals; W. H. Ayscue, for isocyanates; and H. L. Lawrence, for neoprene and "Hypalon." P. Ottenhoff is export sales manager; H. H. Abernathy is technical sales manager, and V. A. Cosler is promotion sales manager. S. G. Byam is technical editor for the Division. Director of the Elastomers Laboratory is H. G. Bimmerman, with A. M. Neal and A. C. Stevenson assistant directors. Most of the planning and design work for the new laboratory has been the responsibility of W. N. Keen as chief engineer.

The staff of the new laboratory consists of 66 chemists and chemical engineers and 125 technicians.

Basically, the laboratory is divided into operating and non-operating areas. In the operating area, the mill room is equipped with mills, extruders, vulcanizing, compounding, and mixing equipment of the latest design. Completely isolated from the carbon black area of the main mill room are non-black and color rooms, each with its own mills and presses. A specially built press for operation at temperatures up to 500° F. is available in the main mill room area.

The latex area consists of various subareas where evaluations are made of natural and synthetic latices in such products as dipped goods, paper, elasticized concrete, and foams.

Urethane foam developments and end-product applications are conducted in a third laboratory area which has separate air-conditioning equipment and specially designed hooded benches. The applications area includes such equipment as a continuous foam producing unit, spray booth, and a new intermittent foam molding unit.

The testing area includes standard industry equipment as well as several pieces of specialized design. In addition, the operating area includes sections for quality control, storage of raw and finished materials, and a mechanical work shop.

Some of the work being carried out at the Elastomers Laboratory at present and indicative of future new or improved rubber products that may be developed there include: wire coverings, fabric coatings, white tire sidewalls and paints made of "Hypalon" synthetic rubber. Longer lasting three-elastomer tire treads, tubeless tire innerliners, and tire sidewalls, elasticized concrete, cut thread, and automotive fuel line tubing to replace metal lines are a few of the new developments in which neoprene is used.

Pioneers in the field of isocyanate chemistry, Elastomers Laboratory chemists are in the forefront in the development of rigid and flexible urethane foams. They are also working on urethane rubbers for such products as tires, flexible coatings, and shoe soles.

New plants have been or are being built for increased output of "Hypalon," neoprene, and isocyanates and are evidence of the company's confidence in the future of these materials.

H. K. Porter Shows Film

H. K. Porter Co., Inc., New York, N. Y., presented a showing of a new motion picture depicting the activities of its various divisions at a press conference in its home offices, April 19. Called "Serving Industry," the film, processed in color, traced the history of the company, described its remarkable growth after World War II, and detailed the operations of its divisions, which make rubber products, wire, fittings, rolled steel, and other goods. The rubber goods producer is Quaker Rubber Corp., Philadelphia, Pa.

Monsanto Affiliates Unit

A new Domestic Subsidiaries and Affiliates Division to administer its interests in companies in which it has an affiliation has been formed by Monsanto Chemical Co., St. Louis, Mo. The new division will concern itself with the affairs of such companies as Shawinigan Resins Corp., Chemstrand Corp., Mobay Chemical Co., and some others.

J. Russell Wilson, general manager of Monsanto's research and engineering division, has been named general manager of the new division. Replacing Mr. Wilson in his former position is Howard K. Nason, formerly director of research and development for the organic chemicals division. Mr. Wilson was also appointed to serve as director of Monsanto's patent department.

New Navy Specifications on O-Rings and Hose Issued

Three new Military Specifications on rubber goods have been issued by the Department of the Navy's Bureau of Ships, Washington, D. C. They are described as:

MIL-G-18586, covering O-rings for use aboard naval vessels, serviceable to —20° F., and primarily for electrical switch-boxes and other electrical closures, but also for use in other general applications for static seals which are not exposed to temperature extremes. Two classes of materials are specified: Class 1 for butadiene-styrene copolymers; and Class 2 for butadiene-acrylonitrile copolymers.

MIL-H-19030, covering wire reinforced rubber hose for steam service up to a maximum working pressure of 100 psi. gage and a maximum temperature of 338° F., and issued for temporary steam connections from docks to ships and from ships to ships. This hose should also find use in other temporary steam connections where medium steam pressures are involved.

MIL-H-19091, specifically covering a strength, six-inch-size buoyant type of very light weight, smooth-bore, high discharge hose for transferring diesel and furnace oils and aircraft fuels by the astern method.

Items furnished under Specifications MIL-G-18586 and MIL-H-19030 shall be ones which have been tested and have passed the qualifications tests described in the respective specifications, the Bureau of Ships says. Manufacturers are advised to arrange to have their products tested for qualification in order that they may be eligible to be awarded contracts.

Reports Safety in Industry Showed Advances in 1954

Final statistics on safety in the rubber industry during 1954 have been released by the Rubber Section, National Safety Council, Chicago, Ill. Safety in all sections of the industry showed considerable improvement over the 1953 record, with the frequency and severity rates of the entire industry falling 14 and 20%, respectively. The industry ranked eighth in frequency and ninth in severity among the 40 industries canvassed.

Statistical breakdown of the industry for 1954 was reported as follows:

FREQUENCY RATES

	No. of Units	Deaths & Permanent Disability	All Injuries	% Change from 1953
Entire industry	133	0.32	3.97	—14
Rubber footwear	12	0.12	1.44	—41
Tires and tubes	60	0.28	4.21	—11
Industrial rubber goods	30	0.70	4.88	—24
Others	31	0.26	4.15	—22

SEVERITY RATES

	No. of Units	Deaths & Permanent Disability	All Injuries	% Change from 1953
Entire industry	133	0.27	0.39	—20
Rubber footwear	12	0.09	0.12	—40
Tires and tubes	60	0.34	0.43	0
Industrial rubber goods	30	0.36	0.49	—63
Others	31	0.16	0.32	—26

The best records were set by the following companies in certain sections of the industry:

The Firestone Tire & Rubber Co., Memphis Tire Plant, Memphis, Tenn., with 7,721,421 injury-free manhours; United States Rubber Co., Naugatuck Footwear Plant, with 10,250,040 injury-free manhours; U.S. Rubber, Providence, R. I., (industrial rubber goods) with 5,688,369 injury-free manhours; and U.S. Rubber Reclaiming Co., Buffalo, N. Y., with 4,271,657 injury-free manhours.

Baker Developing Uses for New Castor-Oil Products

More than 40 chemical products derived from castor oil are now being manufactured on a pilot-plant scale by Baker Castor Oil Co., New York, N. Y., according to a company catalog recently made available.

Since most of the products are new and said to be unique in chemical structure, application information is so far speculative, but Baker is offering experimental samples to interested concerns for collaborative evaluation. Its own laboratories are now engaged in a program to develop potential uses for the new derivatives.

The compounds include fatty acids; ricinoleate, hydroxystearate, acetoxystearate, undecylenate, and epoxy esters; metallic soaps; soap solutions; an alcoholysis catalyst; vinyl lubricants; and synthetic waxes. Many of these are reported to show promise for application in the rubber and plastics industries.

The catalog, entitled "Catalog of Pilot-Plant Products," as well as individual property sheets on the new materials, may be obtained on request from the company's commercial development department, 40 Avenue A, Bayonne, N. J.

NAWMD Scrap Men Meet

The Scrap Rubber & Plastics Institute of the National Association of Waste Material Dealers held a business session during the Association's recent forty-third annual convention at the Waldorf-Astoria Hotel, New York, N. Y. Presiding was the Institute's chairman, Samuel Tanney, Tanney-Costello, Inc., Akron, O.

Among the subjects discussed was the difficulty of reclaiming plastic wire and cable insulation for commercial resale. The question of wider dissemination of scrap rubber specifications to dealers was also posed.

A brief panel discussion on "What's Ahead in 1956?" was held during an NAWMD press luncheon. Representatives of the eight divisions of the Association participated. Most speakers expressed their disbelief in accurate forecasting, but were generally optimistic over the business situation during 1956. Undue government control was condemned by some panelists.

Tentative figures released by the NAWMD put 1955's production of reclaimed rubber in the United States at 365,000 short tons, compared to the 287,940 short tons produced in 1954.

Named by Aetna-Standard

E. E. Swartswelter has been named chairman of the board and chief executive officer of Aetna-Standard Engineering Co., Pittsburgh, Pa., and has been succeeded as president by H. G. Coffey. Also appointed were William Rodder, first vice president; Glenn W. Garwig, vice president in charge of sales for the cold drawn division; A. J. Morgan, vice president in charge of sales for the flat rolled products division; Frank E. Turner, vice president in charge of pipe and tube sales; William Jardine, treasurer; and W. W. Wachsman, assistant treasurer.

Mr. Swartswelter reported the largest backlog of orders in the company's history, with requests for deliveries of some types of equipment extending into the first quarter of 1958.

Expanding Avon Lake Plant

B. F. Goodrich Chemical Co., Cleveland, O., will build new facilities at its Avon Lake, O., Geon polyvinyl resin plant, almost doubling annual output there. To cost $8,000,000 the construction project will begin in June, and completion is expected by March, 1957. A new boiler plant and additions to the development laboratories are included in the program.

Planning Cuban Tire Plant

A $4,000,000 tire plant having an annual rated capacity of 100,000 truck and passenger-car tires will be built by The Firestone Tire & Rubber Co., Akron, O., in Havana, Cuba, the firm's thirteenth tire plant outside the United States.

The plant will be constructed on a 12-acre tract of land in the south section of the Cuban capitol where a recently completed Firestone warehouse and branch sales office are located. The new facilities will directly employ about 500 people and will use many local manufacturing supplies, such as rayon.

Cuba is said to have 150,000 motor vehicles on its roads, and it is expected that most of the production of the new plant will be sold on the domestic market.

Cyanamid Doubling Output of Acrylonitrile at Fortier

Construction of new facilities at its Fortier plant near New Orleans, La., which will double production of acrylonitrile, has been started by American Cyanamid Co., New York, N. Y., as one phase of an ambitious expansion program there.

Already completed is a new monomethyl styrene plant. Still in the planning stage are facilities for the large-scale production of acrylamide, a derivative of acrylonitrile, said to have potentially wide industrial uses.

Acrylonitrile is a component in the manufacture of certain synthetic fibers and synthetic rubbers. Monomethyl styrene is used in the production of thermoplastic molding compounds.

The Fortier plant was originally designed to permit expansion and was begun in 1952. The new installations will be under the supervision of the company's engineering and construction division and will be designed by Chemical Construction Corp.

Doubling of the acrylonitrile capacity will entail complete duplication of several units, the company says, such as those producing oxygen, acetylene, and hydrogen cyanide, and will mean increasing the plant's sulfuric acid and refrigeration facilities and a number of service areas. Work is also being planned on existing units producing acrylonitrile derivatives.

American Cyanamid claims to be the nation's leading producer of acrylonitrile.

Columbian Builds Lab Unit

Columbian Carbon Co., New York, N. Y., is building a new office and laboratory center in Monroe, La., consisting of three buildings having a total floor area of 25,000 square feet. To cost about $350,000, the project is expected to be finished by October, 1956.

One building will house a rubber laboratory, which will include a compounding and mixing room, a remilling room, a curing room, a testing room, and office, storage and service space. Another will contain a chemical laboratory including carbon black testing facilities, a gas analysis laboratory, an oil analysis laboratory, a dark room, facilities for water analysis and special studies, and office, storage, and service space. The third structure will be an office and engineering building.

Operating headquarters centered in the project will cover the company's carbon black manufacturing activities in Louisiana, Texas, Arkansas, New Mexico, and Kansas, together with local offices for oil and gas operations, and for timber and farm operations in this area.

Passenger-Car Air Spring Unveiled By General Tire

The General Tire & Rubber Co., Akron, O., has entered the air spring field with the prediction that air springs will enjoy wide usage in 1958 autos and trucks.

The company's passenger-car air spring was unveiled by L. A. McQueen, vice president of the firm, at General's annual dealer convention at the Essex House, New York, N. Y., April 12. Previously, he had announced the company's commercial introduction of an air spring for trucks.

Air springs are rubber and nylon bellows girded by a steel band. They constitute a new type of suspension system for vehicular bodies and have already been adopted by some manufacturers of buses and lightweight trains.

Mr. McQueen listed the following advantages of air springs: a softer, more comfortable ride; increased safety because the headlight and inside rear-view mirror remain on a constant level; a low, sleek appearance for vehicles; and a quieter ride.

He said that more than 10,000 of the company's air springs are now being used in the truck and trailer industries. Among the trucking firms mentioned as having successfully experimented with the General air spring are William F. Crossett, Inc.; Pacific Intermountain Express Co.; and Yellow Transit Fleet.

Mr. McQueen cited reports that these air springs had increased tire life and required less heavy maintenance than metal springs. One trucker declared that the tires on his vehicles had had an average of three flats a year while using the air springs, compared with five flats a week with the conventional spring.

Sees Hewitt-Robins Boom

Incoming business of Hewitt-Robins, Inc., Stamford, Conn., during the first quarter of this year was more than $17,000,000, the highest figure in any three-month period in the firm's history and exceeding by more than 50% the business volume of the first quarter of 1955.

In revealing the figures to an annual meeting of stockholders at Buffalo, N. Y., Thomas Robins, Jr., board chairman and president of the company, added that the volume of incoming business during April had been even higher than the average for the first three months.

"Even if sales to the automotive industry continue at present reduced levels, our overall operations should show a substantial gain in sales and earnings in the months immediately ahead," he declared.

All members of the board of directors and company officers were reelected.

Want Mechanical Engineers

By 1965 the number of mechanical engineers employed in the rubber industry will be double what it is now, according to Donald R. Scheu, field engineer with B. F. Goodrich Industrial Products Co., Akron, O.

Addressing a University of Michigan student body during a "Seminar of Industry Review," Mr. Scheu estimated that more than 3,000 mechanical engineers in the United States are now at work designing and engineering tires, conveyor belts, hose, and other rubber products.

In addition, more than 4,000 persons with mechanical engineering education are employed in the industry in other capacities, such as industrial sales, plant engineering, maintenance engineering, production supervision, packaging, and purchasing engineering, he said.

Painting an encouraging picture for new mechanical engineering graduates, the Goodrich engineer declared that the increasing complexity of rubber products manufacture and the seemingly endless variety of new materials and new products introduced by the industry in recent years are major factors responsible for the growing need of mechanical engineering skills in the rubber industry.

Monsanto Ups School Aid

An expanded program for his company's financial aid to scientific education during the 1956-57 school year has been announced by Carroll A. Hochwalt, vice president of research, development, and engineering for Monsanto Chemical Co., St. Louis, Mo.

A total of 83 American colleges and universities will begin from 111 separate direct aid awards under the program. This is an increase of 30 in the number of schools aided and 39 in the number of awards over the company's 1955-56 program.

The awards for the coming school year include 29 fellowships, 41 undergraduate scholarships, and 41 cash grants. The fellowships are established for graduate study with the larger part of their $3,000 average value going to the individual. The scholarships are intended to cover tuition costs.

The major part of the grants will be given to the chemistry and chemical engineering departments of the universities. Other departments are mechanical engineering, geology, textiles and fibers, pharmacy, and biochemistry. Sixteen liberal arts colleges will also benefit in the revised program.

"Voice of Firestone" Cited

The George Foster Peabody Radio-Television Music Award for 1955 has been presented to the "Voice of Firestone," a musical program, simultaneously broadcast on radio and shown on television, which is sponsored by The Firestone Tire & Rubber Co., Akron, O.

The citation praised the company for showing "the highest sensitivity, not only in the matter of superb program standards, but also in its understanding of advertising proprieties." The program has been heard on radio for 28 consecutive years, the nation's oldest coast-to-coast presentation, and has been telecast for the last eight years.

In accepting the award, A. J. McGinness, national advertising manager for Firestone, said that the program "has sought to bring the best in music played and sung by the best artists to the people of America."

Picco Ex-Warehouse Sales

Pennsylvania Industrial Chemical Corp., Clairton, Pa., is now administering all LCL and LTL shipments of its chemicals from its New England district warehouse through its Boston, Mass., sales office, the company reveals.

Picco says it is assuming full responsibility for sales in the New England area, which includes Maine, New Hampshire, Vermont, Massachusetts, and Rhode Island. Harwick Standard Chemical Co. will continue to act as Picco representative on a national basis to the rubber and shoe industries. The Harwick Standard Chemical organization and Carl Meyer will continue to serve the New England area from that organization's Boston office.

The change on LCL and LTL shipments will apply only to ex-warehouse sales, Picco declares.

Styrene Plant by Cosden

A $3-million styrene plant with an annual capacity of 20 million pounds will be built by Cosden Petroleum Corp., Big Spring, Tex., on the site of its petroleum refinery there. Completion is scheduled for November.

Raw materials for the plant will come from the xylene output of the company's BTX plant. Improved separation techniques for the recovery of ethyl benzene directly from petroleum stock, such as xylene streams, will be used at the facilities. The ultra-fractionation process will use 200-foot towers, called the tallest in the industry.

Wellco Affiliates in Haiti

Wellco-Ro-Search, Waynesville, N. C., has concluded an affiliated agreement with Fabrique National de Chaussures S.A., Port-au-Prince, Haiti, for the manufacture of all types of Ro-Search footwear, according to Curt Kaufman, vice president of the company.

The Haitian firm is the first in that country to manufacture vulcanized rubber footwear and the first to operate a rubber mill. It estimates that its daily production will reach 2,000 pairs of footwear. Production has already begun.

Claremont Pigment Moves

Claremont Pigment Dispersion Corp., formerly of Brooklyn, N. Y., has moved its facilities to a new plant at 39 Powerhouse Rd., Roslyn Heights, L. I. Additional equipment has doubled its production capacity, the firm says, and a new line of color granules for use in polyethylene plastics has been added.

The new plant has more than 30,000 square feet of floor space and is a long, one-story building organized to permit a single production flow from raw materials to finished product, according to Claremont. The plant is served by a railroad siding and off-street truck platforms.

Naval Research Publication

The Naval Research Laboratory's monthly "Report of NRL Progress" is being made available to the public by the Office of Technical Services, United States Department of Commerce, Washington, D.C. The publication contains articles concerning non-classified research conducted by the NRL.

Issues beginning with January, 1956, have been put on sale at $1.25 a copy. The periodical is available on a single issue basis or by subscription.

According to John C. Green, director of OTS, the publication affords private businesses and laboratories the opportunity "to keep up with a variety of current Navy research projects, shortcomings discovered and advancements made in materials and methods, and ideas for new technological developments and innovations."

An article entitled, "A Rubber Compatible and Ice-Resistant Lubricant for Aircraft Ordnance," appearing in the February issue, is typical of the subjects covered. Articles and problem notes on chemistry, electricity, mathematics, solid-state physics, and nuclear and atomic physics, among others, also are included.

UCC Starts Silicone Unit

Some units of the new Long Reach, W. Va., silicone plant of Union Carbide & Carbon Corp., silicones division, New York, N. Y., are in operation, according to T. J. Coleman, general manager of the division. Of the 360 persons expected to be employed when maximum production is reached, 171 have so far been hired.

The company's original silicones plant at Tonawanda, N. Y., will continue to be operated. Silicone research and product development activities will also continue to be headquartered there. Silicone production at Long Reach will in some measure be dependent on processes centered in Tonawanda.

The Long Reach plant was constructed on a 1,431-acre site which will provide for future expansion, Mr. Coleman said. The reactor capacity there has been increased beyond the original design, and additional plans are being drawn for new silicone rubber compounding equipment.

Reversible Dock Bumpers

Dock bumpers made of reversible rubber-coated fabric are now being offered in three sizes by Bumpers, Inc., Cleveland, O. These bumpers are designed to cover a facing depth of 6, 9, or 12 inches and can be obtained with standard lengths of 14 and 36 inches and in standard thickness of 4½ inches, according to the company.

Called Flex-O Loading Dock Bumpers, they can be bolted to wooden docks, welded to steel plates, or lagged to concrete facings. Their resilience is said to be unaffected by low temperatures. The units are designed with reversible brackets which permit the reversing of the fabric to obtain double product life.

Canadian Kleinert Plant

A sewing factory and sales office at Scarboro, Ont., Canada, will be constructed by I. B. Kleinert Rubber Co., New York, N. Y. The plant will occupy four acres of land and will include modern equipment not now found anywhere in Canada, according to J. A. McWilliams, factory manager.

D. J. Donovan, national sales manager, will make his headquarters there.

Kleinert has operated a factory in Toronto since 1897 and maintains sales offices in Moncton, Quebec City, Montreal, Winnipeg, Calgary, and Vancouver.

The company was organized in the United States in 1871 and manufactures a wide range of rubber and plastic consumers goods.

Win with Firestone Tires

All the top events through the measured mile and over a 4.1-mile course at the seventh annual NASCAR International Safety and Speed Trials at Daytona Beach, Fla., February 12-26, were won on two new tires of The Firestone Tire & Rubber Co., Akron, O., the company reveals.

The Firestone tires used were the regular production Super Sports 170 and a version of it redesigned with five circumferential ribs to provide lateral stability and maximum safety. None of the Firestone tires in the grueling stock car races failed, the company declares.

Wider Seiberling Tire Line

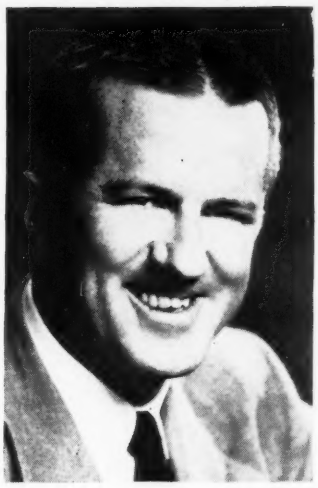
Seiberling Rubber Co., Akron, O., is again producing its T-190 passenger tire, a premium, white sidewall tire with nylon cord construction. Manufacture of the tire was said to have been discontinued last summer to make way for increased production of the firm's Sealed-Aire tire.

The T-190 features "silencer" blocks built into the outer tread grooves for reduced noise and improved traction and comes in sizes 6.70-15 through 8.20-15.

Seiberling also revealed that it was making its Highway 110 truck tire in both tubeless and tubed designs. Of rayon body construction, the tire has such features as heat vents for cooler performance, a larger-than-normal tread area, and tread grooves reinforced with extra rubber. The tire is available in sizes from 6.00-16 through 11-24.5.

Goodyear Tire in Contest

A Harley-Davidson motorcycle equipped with a tire made by The Goodyear Tire & Rubber Co., Akron, O., won the American Motorcycle Association's annual 100-mile amateur beach and road track race at Daytona Beach, Fla., March 10. The vehicle was equipped with a Goodyear Super-Eagle motorcycle tire and a Beck Frontrunner. It was ridden by Bates Molyneux, a Navy aviation machinist, who set record-breaking 93.58-miles-an-hour average pace.



G. William Boyd

Robert F. Brown

Emery Splits Sales Unit

Two new sales departments to replace its single chemical sales operation have been formed by Emery Industries, Inc., Cincinnati, O., to "provide better and more expert technical help to the many industries served."

In making the announcement, K. K. Boyd, vice president in charge of sales and purchases, said the new arrangement would bring related product lines into closer alinement and make possible improved sales attention to both new and old products.

The first new group, the organic chemical sales department, will be headed by Robert F. Brown, formerly sales manager of the company's outgoing chemical sales department. Robert Hull and Vern Colby have been named assistant sales managers. The department will handle the sales of all non-fatty Emery products.

The second new group, the fatty acid sales department, will be headed by G. William Boyd, formerly sales manager of the firm's Sanitone division.

Firestone Student Awards

Twenty-nine college scholarships have been awarded children of employes of The Firestone Tire & Rubber Co., Akron, O., bringing to 92 the number of such awards granted since the program began in '33.

Thirteen of the new winners, representing 12 states, will study engineering or science. Ten will prepare for teaching careers; two for nursing; and one each for the ministry, law, commercial art, and psychiatric field work. Thirteen of the 29 are girls.

The scope of the program is being stepped up, providing for 20 annual awards, or a total of 80 students receiving educations under the program each year. The scholarships provide for full tuition, academic fees, textbooks, and a contribution toward living costs. They are renewable each year. Sixty students have been enrolled in colleges or universities under the program this year.

General Stockholders Vote

Stockholders of The General Tire & Rubber Co., Akron, O., have approved an amendment to the articles of incorporation to revise provisions of the 71,093 shares of cumulative preferred stock outstanding to bring them more within the general framework of the firm's other securities.

Also approved was a revised retirement program for salaried employes to include a profit-sharing plan.

All 16 directors of the company were unanimously reelected. J. A. Andreoli, executive vice president of the General Tire & Rubber Export Co., was promoted to a vice presidency of the parent company.

Reveal Sealed-Aire Origin

The Sealed-Aire, a sealant-containing tubeless tire manufactured by The Seiberling Rubber Co., Akron, O., first introduced to the trade last fall, evolved from a bullet-sealing inner tube created by the company during World War II for U. S. Army combat vehicles, the company reveals.

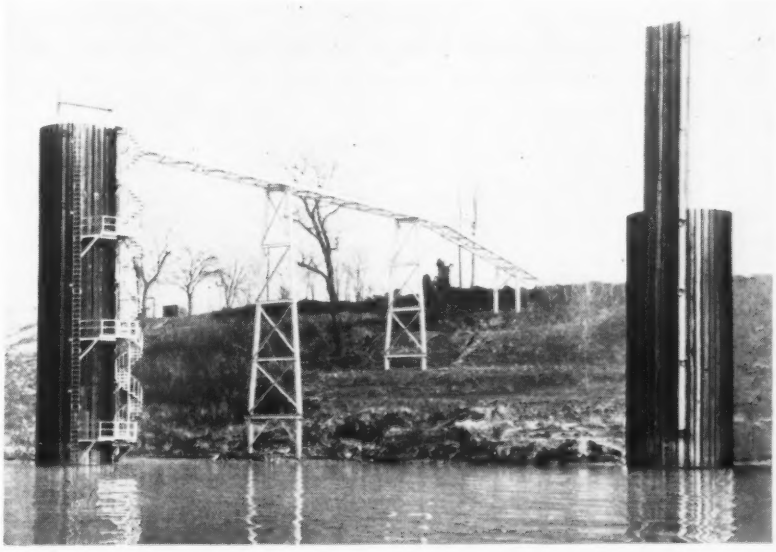
The tire's sealant is held permanently in place by what is termed a bulkhead construction which prevents high speed and heat from causing the gum to bunch up, according to Seiberling. The tire differs from others on the market "in that the live rubber cells built into the crown of the tire cover the full tread area, prevent flowing and shifting of the sealant" and eliminate out-of-balance conditions, it declares.

Premium-priced and of nylon cord construction, with an extra nylon breaker ply under the tread for added strength, the Sealed-Aire has a rib-type tread claimed to be quieter on the road than conventional treads. This tire is available only with white sidewalls.

Certifies Silicone Rubbers

Certification of batch-to-batch uniformity of silicone rubber gums has been put into effect by the silicone products department of General Electric Co., Waterford, N. Y.

Each pail of gum which has passed more than 30 quality control tests during the various stages of manufacture is identified by a gold sticker and a quality control laboratory serial number, General Electric reveals.



LIQUID RAW MATERIALS for American Synthetic Rubber Co., Louisville, Ky., will be unloaded at this recently completed barge-mooring facility on the Ohio River. The two steel sheet pile cells shown have 18-foot diameters and are 72 feet above normal water elevation to meet the exigencies of extreme variations in the level of the river. Pipe lines from moored barges are carried to shore across the 222-foot elevated walkway

General Division Buys Firm

The Cuyahoga Falls, O., General Metal Products division of The General Tire & Rubber Co., Akron, O., has undergone a 50% expansion by purchasing the adjacent Dougherty Machine division of Fawick Corp., it has been revealed by M. G. O'Neil, General's executive assistant to the president.

The acquisition will enable the Cuyahoga firm to increase its rate of production of special rubber machinery, tools and dies, molds for rubber and plastic materials, aircraft wheels, and industrial wheels and hubs, Mr. O'Neil said.

Ball Park Gets Conveyors

Eight passenger conveyor belts totaling 400 feet will be installed at Chicago's huge Wrigley Field, it has been revealed by Stephens-Adamson Mfg. Co., Aurora, Ill., manufacturer of the Speedwalk conveying units bought by the ball park.

The conveyors will operate in two sections of four units each and will provide a total vertical lift of 60 feet. The belts are 42 and 66 inches wide, vary in length from 25 to 75 feet, and slope from 5-7½ degrees. The belts are accessible to passengers at any point.

The units will convey passengers from the Field's ground level to the grandstand and from there to the upper deck. The lower four belts will have a rated capacity of 10,800 people an hour; the upper four belts, 7,200 people.

Four centrally located control boxes will operate the conveyors in four groups of two units each. When the event at the Field has concluded, the direction of the belts will be reversed.

Doubling Opalon Production

The plastics division of Monsanto Chemical Co., Springfield, Mass., has put into operation new facilities which more than double the company's capacity to produce vinyl chloride polymers and copolymers, according to Martin G. Caine, the division's sales manager.

Although the new rated capacity of the plant was not revealed, Mr. Caine said that increased production there should help boost total United States vinyl resin output in 1956 to 600 million pounds. The industry turned out 500 million pounds of the resins last year.

Monsanto supplies vinyl resins and compounds under the trade mark Opalon.

Canada

Canadian Titanium Pigment

Construction of Canada's first titanium pigment plant has been begun by Canadian Titanium Pigments, Ltd., a subsidiary of National Lead Co., New York, N. Y. The unit will be erected at Varennes, Quebec, about 15 miles northeast of Montreal. Cost of the project is estimated at $15,000,000.

The entire output of the plant will go to Canadian industry. Employment will be about 300. Titanium pigments are used in the rubber and plastics industries, among others.

Imports Seen Strangulating Rubber Footwear Industry

The Canadian rubber and canvas footwear industry has issued what appears to be a final warning to the government to restrict competitive imports immediately or face the total extinction of the domestic industry.

Spokesmen have pointed out that during the year ending last October imports of canvas shoes amounted to 211,903 pairs; while imports of waterproof footwear totaled 163,593 pairs. This increase was phenomenal, from the respective figures of 4,568 and 89,981 pairs imported during the previous 12-month period.

Even a clearer indication of the danger confronting the home industry, they say, is the expectation that 71% of the canvas footwear bought by Canadian consumers this year would be foreign products. In the short span of seven years imports of canvas footwear have mushroomed from less than 1% of domestic sales, with the upward spiral continuing. A similar, though more gradual pattern, is evolving with waterproof footwear.

During the past few years there have been repeated appeals to Ottawa for some action to restrict imports. At one point, a government-industry-labor panel was established to study the problem, but no definite action ever resulted.

Finance Minister Walter E. Harris last fall said that he was unable to recommend action restricting imports. Since no other statements have been forthcoming from government officials, the industry appeal is now considered an ultimatum.

The manufacturers see only three choices remaining to them: ceasing operations altogether; ceasing Canadian operations, but importing footwear themselves; removing their plants to foreign sites.

Thomas E. Boyle

Obituaries

Kurt Maier

The German rubber trade paper, *Kautschuk und Gummi*, has announced the death after a short illness, of its publisher and chief editor, Kurt Maier.

Dr. Maier, who was born on March 22, 1900, in Stuttgart, joined the editorial staff of the former *Gummi-Zeitung* in 1921, becoming its chief editor in 1929. He left the paper in 1935 to take up a position outside the rubber industry, but by 1938 he was again concerned with rubber when he was called on to take over the management, and later the direction, of Fromms Act Gummiwerke. This firm was located in what was to become the East German Zone in 1945, and that ended his activities there.

The practical experience he had gained meantime stood him in good stead when in 1948 he joined the staff of *Kautschuk und Gummi*, whose head he soon became. While the economic aspects of the industry claimed most of his attention, Dr. Maier was keenly interested in the science and technology of rubber as well and was most active in the reestablishment after the war of Deutsche Kautschuk Gesellschaft, with which he had had relations since its foundation, and of which *Kautschuk und Gummi* became the organ.

Thomas E. Boyle

Thomas E. Boyle, manager of international and technical services for International B. F. Goodrich Co., Akron, O., died March 20 of a heart attack.

Mr. Boyle first joined Goodrich on February 14, 1926, as a laboratory technician. He later served in the tire technical department, in tire production, and in a personnel training program.

In 1948 the deceased was appointed manager of a new tire plant in New Zealand, Reid New Zealand Rubber Mills, a Goodrich associate company. He returned to Akron in 1955 and assumed the position he held until his death.

He was born in Ogden, Utah, on June 27, 1903. He was graduated from the University of Kansas in 1925.

Funeral services were held March 23 at Prentice Funeral Home in Akron. Burial took place the same day in Greenlawn Cemetery.

Mr. Boyle is survived by his wife and one son.

EDWARD LYMAN BILL

Edward Lyman Bill, president of Bill Brothers Publishing Corporation, an officer and director in all of its affiliated publishing companies, and closely associated with RUBBER WORLD over 25 years, passed into the great beyond on April 22, in Capetown, Union of South Africa.

Mr. Bill was widely known in the business publication field, being a founder of Business Publication Audit of Circulation, Inc., and a former director of National Business Publications, Inc.

Educated at the University of Wisconsin and Columbia University, he first served in World War I in the American Ambulance Service, French aviation, and the Foreign Legion and later as an officer in the French artillery and cavalry.

Ed spent most of his life in business paper publishing. His was a varied experience, from a stock boy through field reporter, circulation roadman, space salesman, business manager, editor, publisher, and corporate executive.

Through his experience he developed his understanding of people at all levels and versatility in grasping the fundamentals of the various fields served by the Bill Brothers publications.

Ed liked people. Ed liked to help people. For those who were his co-workers he felt a personal responsibility, and through his years he contributed to their well being. It was the same with his friends.

He was widely known as the founder President of the Bonnie Briar Country Club of Larchmont, N. Y., a former President of the Adventurers' Club, and an organizer President of the Cracker Barrel. He was a yachtsman, clubman, connoisseur of antiques, dairy farmer, member of the Bartenders' Union, American Ordnance Association, and official of the State Police.

Mr. Bill is survived by a daughter, Mrs. Frederick Gahagan, of New Canaan, Conn.; a sister, Mrs. Randolph Brown, of Lyme, Conn.; a brother, Raymond Bill, of Greenwich, Conn.; and two grandchildren, Frederick and Caroline Gahagan.

News About People

John W. Pool, Jr., and **B. R. Sarchet** have been advanced to sales department manager and development department manager, respectively, of the chemical division of Koppers Co., Inc., Pittsburgh, Pa. **H. D. Cooper** has been promoted to assistant manager of the division's sales department and is succeeded as manager of eastern district sales by **R. F. Seubert,** formerly the division's Pittsburgh sales office supervisor.

Joseph J. Coughlan and **Benjamin F. Brown** have been appointed technical sales representatives with the plastics sales division of Hercules Powder Co., Wilmington, Del.

F. W. Blanchard has been appointed to the newly created position of assistant to Executive Vice President Austin Goodyear, of Hewitt-Robins, Inc., Stamford, Conn. Blanchard was formerly manager of operations of the industrial rubber division plant in Buffalo, N. Y. **A. F. Dantino,** formerly production manager, succeeds Mr. Blanchard as manager of operations of the industrial rubber division. **Robert C. Estes,** former purchasing agent for the division, is the new production manager.

Arthur K. Brintnall has been named manager of corporate training and personnel research for The B. F. Goodrich Co., Akron, O.

E. M. Eickmann has been advanced from manager to general manager of the aviation products division of The Goodyear Tire & Rubber Co., Akron, O.

A. L. Freedlander, president of The Dayton Rubber Co., has been elected chairman of the board of Copolymer Rubber & Chemical Corp., Baton Rouge, La. Succeeding him as president of Copolymer is **A. K. Walton,** supervisor of the tire division of Sears Roebuck & Co. Reelected were **John C. Gates,** vice president of Gates Rubber Co., as secretary; and **Frederick Machlin,** president of Armstrong Rubber Mfg. Co., as treasurer. Members of Copolymer's executive committee, in addition to the above, are **James H. Hoffman,** president of Mansfield Tire & Rubber Co., and **James A. Walsh,** president of Armstrong Rubber Co.

S. T. Williams, general manager of A. Schrader's Son, Brooklyn, N. Y., has been named a director of Scovill Mfg. Co., Inc., parent company of Schrader. Mr. Williams, who is also an inventor and a technical writer, first joined Schrader in 1929.

Alfred Ohlander

Alfred Ohlander has been named head of the Boston sales office of The New Jersey Zinc Sales Co., New York, N. Y.

Melbourne N. Thomas, manager of the merchandise distribution department of The Goodyear Tire & Rubber Co., Akron, O., has been promoted to manager of general merchandise and material control, succeeding **William H. Fleming,** who has retired after 39 years of service with the company.

Robert G. Bradley has been named product manager of the Silentbloc and vibration department of The General Tire & Rubber Co., Akron, O. The department's plant is at Logansport, Ind.

C. A. Mackintosh has joined Westwood Chemical Co., New York, N. Y., as sales representative in the eastern area. Westwood Chemical represents Archer-Daniels-Midland Co. (hydrogenated fatty acids) and Synthetic Products Co. (stearates and stabilizers).

J. G. Berry has been appointed director of field engineering and service for the tire division of United States Rubber Co., New York, N. Y., and has been succeeded as automotive engineering manager by **W. I. Ford,** formerly chief engineer of field engineering and service.

George Schaeffer is now with Arrowhead Rubber Co., Downey, Calif.

Edward J. Higgins has been appointed assistant general manager of the international division of United States Rubber Co., New York, N. Y., succeeding **Fred S. Carpenter,** who has retired after 43 years of service in the company's general laboratories, plantation, tire, chemical, and international divisions. Mr. Higgins joined the company in 1935 as a development engineer.

James K. Stevenson

James K. Stevenson has been named manager of the New England district office of Pennsylvania Industrial Chemical Corp., Clairton, Pa.

Arthur B. Bush has been named product manager of the sundries department of B. F. Goodrich Industrial Products Co., Akron, O.

Paul A. Barkmeier, formerly a vice president of Radio Corp. of America, has been appointed director of marketing services at Borg-Warner Corp., Chicago, Ill.

Donald A. Regnier and **Errol M. Thompson** have joined the technical staff of the Resinous-Reslac department, chemical division, of Bordon Co., New York, N. Y. They will be assigned to the department's Chicago, Ill., and Peabody, Mass., plants respectively.

Herbert E. Pike has been promoted to national manager of Kraft sales and service for The General Tire & Rubber Co., Akron, O., in which position he will supervise the company's retreading program.

Leland E. Spencer, vice president, The Goodyear Tire & Rubber Co., Akron, O., has been named an executive reservist with the Office of Defense Mobilization, Washington, D. C., in which capacity he will recruit, organize, and direct the reservist program in the rubber industry.

J. Ernest Miller

Hendrik C. J. de Decker

J. Ernest Miller, sales manager for Goodrich-Gulf Chemicals, Inc., Cleveland, O., has been named vice president of sales.

John A. Sargent, president of Diamond Alkali Co., Cleveland, O., has been elected a director of The White Motor Co., Cleveland.

Hermann V. Boenig has joined the organic research department staff of the research division of The Goodyear Tire & Rubber Co., Akron, O.

Charles Evans, formerly of Arrowhead Rubber Co., Downey, Calif., has joined The General Tire & Rubber Co., Los Angeles, Calif.

R. C. Boltz and **J. R. Hulten** have been appointed eastern division and central division managers, respectively, for Carbide & Carbon Chemicals Co., division of Union Carbide & Carbon Corp., New York, N. Y. **H. P. White** has been named Pacific Coast assistant division manager.

Charles A. Eaves, Jr., has been named assistant manager of the petroleum sales department of The Goodyear Tire & Rubber Co., Akron, O.

Vincent Meyer has been promoted to assistant division engineer for coated abrasives of Minnesota Mining & Mfg. Co., St. Paul, Minn.

F. Lindsay Power has been advanced to division engineer for coated abrasives for Minnesota Mining & Mfg. Co., St. Paul, Minn.

William C. Weirath has been appointed assistant manager of commercial sales for The General Tire & Rubber Co., Akron, O.

P. Dudley Kaley is now manager of sales, fiber glass division, Pittsburgh Plate Glass Co., Pittsburgh, Pa.

Hendrik C. J. de Decker, Fedde H. D. Akkerman, and **Sjirk van der Burg,** formerly with Rubber-Stichting, Holland, have joined the staff of the research and development department of United States Rubber Co., New York, N. Y., where they will do fundamental research on the chemistry of rubber and plastics. Dr. de Decker was director of research for the Dutch research organization.

Edward D. Toland, Jr., has been elected treasurer of Monsanto Chemical Co., St. Louis, Mo., succeeding **William W. Schneider,** vice president and member of the board of directors.

R. E. Pauley has been advanced to general manager of the foam products division of The Goodyear Tire & Rubber Co., Akron, O. He first joined Goodyear in 1935.

Bob Wade has resigned from Wade Sponge Rubber Co. to become liaison man between the technical and the production divisions of Kirkhill Rubber Co., Brea, Calif.

Roy D. Perdue, Jr., and **Joseph H. Murphy** have joined National Polychemicals, Inc., Wilmington, Mass., as project engineer and researcher, respectively.

Robert G. Burson has been appointed sales manager of the industrial V-belt division of The Dayton Rubber Co., Dayton, O.

William T. Smith has been assigned as sales representative to the New York, N. Y., office of the chemical division of The Goodyear Tire & Rubber Co., Akron, O.

Gerald J. Bayern, formerly assistant director of engineering for Foster D. Snell, Inc., has joined Barrett Division, Allied Chemical & Dye Corp., New York, N. Y., as marketing and economic analyst.

Sherman R. Lyle has been appointed Cleveland district manager of the steel and tube division of The Timken Roller Bearing Co., Canton, O., succeeding **R. P. Donnell,** who becomes the division's New York district manager.

Edmund Greene has been advanced to director of marketing research for Monsanto Chemical Co., St. Louis, Mo.

Louis E. Benton has joined Phoenix Mfg. Co., Joliet, Ill., as sales manager of its rubber division.

John Meyn, formerly with Rubber Teck, Inc., is now employed by Pacific Moulded Products Co., Los Angeles, Calif.

Horace W. Boynton and **W. Mayo Smith, Jr.,** have been appointed assistant directors of research, the latter in charge of polymerization and plastics research and development, for Escambia Bay Chemical Corp., Cambridge, Mass.

Emmanuel Bleecker has signed up with Western Insulated Wire, Inc., Los Angeles, Calif., as chief chemist.

Glen Colclough has joined Molded Products Division of Stauffer Chemical Co., Los Angeles, Calif.

William J. Roemer and **Charles R. Hinkley** have been named director of purchases and purchasing agent, respectively, for Acushnet Process Co., New Bedford, Mass.

Robert Velgos has joined the research staff of Michigan Chemical Corp., St. Louis, Mich.

Wesley H. De Sellem, formerly vice president and treasurer of Pacific Tire & Rubber Co., has been appointed treasurer of W. J. Voit Rubber Corp., Los Angeles.

Ross Hershey has been advanced to Buffalo district sales manager of the Timken Roller Bearing Co., Canton, O.

Russell C. Hirtle has joined Indoil Chemical Co., Chicago, Ill., as New England sales representative.

Richard O. Roblin, Jr., and **Robert P. Parker** have been named assistant general managers of the pigments and research divisions, respectively, of American Cyanamid Co., New York, N. Y.

J. S. Bruskin has been named general manager of the films and flooring division of The Goodyear Tire & Rubber Co., Akron, O.

Randolph H. Barnard, director of several glass companies, has been elected a director of The Landers Corp., Toledo, O.

James F. Reid has retired as general production manager at The Timken Roller Bearing Co., Canton, O., and will become assistant director and chief of the ferro alloys section of the iron and steel division of the Business & Defense Services Administration of the United States Department of Commerce, Washington, D.C.

Edgar W. Thompson, who specialized in the manufacture of neoprene during his 36 years of service with E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has retired. He was the first manager of the company's Louisville, Ky., neoprene plant. His last position was department coordinator of design and construction for du Pont's Montague, Mich., neoprene plant.

Gordon S. Trick and **Emanuel Schoenberg** have joined the diene synthetic rubbers section of the research division of The Goodyear Tire & Rubber Co., Akron, O. **Mrs. Nan Jones** has joined the division's process engineering section; and **Frank Stefan,** formerly with Goodyear Aircraft Corp., has been transferred to that section. **Mrs. Elma Maxson Charlton** has rejoined the division's physical testing laboratory.

Alexander D. Lumsden has been appointed manager of foam slab product sales for the foam products division of Hewitt-Robins, Inc., Stamford, Conn.

L. E. Anderson has been appointed sales manager of the oxychemicals division, naval stores department, of Hercules Powder Co., Wilmington, Del. Others recently named by the department are **Richard J. Both,** to manager of the Chicago district office; **P. J. Reno,** to sales manager of the agricultural chemicals division; and **Allen C. Gunter,** to manager of the Dallas district office.

John C. Heisler, Jr., has been elected assistant treasurer of The Eagle-Picher Co., Cincinnati, O.

Witzel Studio

J. E. Toevs

Mel Sutter Studio

Ferd Nadherny

Ferd Nadherny has been appointed assistant to the director of sales for Godfrey L. Cabot, Inc., Boston, Mass.

Oliver W. Weinkauff has been advanced to director of technology in the research department of the organic chemicals division of Monsanto Chemical Co., St. Louis, Mo. Also promoted in the department were **Harry W. Faust,** to assistant to the director of research; **Ralph H. Munch,** to assistant director of research; and **Kenneth L. Godfrey** and **James O. Harris,** to research section leaders.

Sir W. M. W. Thomas has been elected a member of the board and will become board chairman of Monsanto Chemicals, Ltd., London, England. Sir Miles succeeds **Edward A. O'Neal, Jr.,** vice president for international operations for the firm's parent company, Monsanto Chemical Co., St. Louis, Mo.

W. F. Twombly, vice president of Witco Chemical Co., New York, N. Y., has been appointed consultant on organic chemicals in the chemical and rubber division of the Business and Defense Services Administration of the United States Department of Commerce, Washington, D. C. His duties at Witco will be temporarily assumed by **William C. Walker,** assistant director of advertising and public relations.

Robert P. Ogden, production manager for Pennsylvania Salt Mfg. Co., Philadelphia, Pa., has been named plant manager of the Riverview works of the company's Sharples Chemical Division.

J. E. Toevs has been transferred for one year to the economic research department of Shell Chemical Corp., New York, N. Y., where he will be concerned with forecasting and general planning in synthetic rubber. His position as sales manager of the synthetic rubber sales division will be temporarily assumed by **F. W. Hannsgen,** sales development manager of the division.

Anthony D. Eastman has been appointed director of industrial relations for The General Tire & Rubber Co., Akron, O.

Robert G. Whelan has been elected a director of I. B. Kleinert Rubber Co., New York, N. Y. Also elected to the board was **William White,** in charge of Canadian sales.

R. W. Jones, chemical engineer with the research department of the plastics division of Monsanto Chemical Co., St. Louis, Mo., and **Melvin E. Tuvell,** research chemist with the research department of the company's inorganic chemicals division, have been granted leaves of absence for technical studies at universities of their choice.

J. P. Seiberling, since 1938 president of Seiberling Rubber Co., Akron, O., and its board chairman since 1950, recently was tendered a special luncheon commemorating his more than 25 years of service with the company.

Donald L. Hart has been promoted to the vinylfilm sales staff of The Goodyear Tire & Rubber Co., Akron, O., and has been succeeded as Cleveland vinylfilm field representative by **Gerald L. Lewis.**

Robert S. Holdsworth has joined National Research Corp., Cambridge, Mass., as group leader of the research division's petrochemicals research department.

Ray M. Ewald has been named technical services superintendent at the New Martinsville, W. Va., plant of Mobay Chemical Co., St. Louis, Mo.

H. F. Schweitzer has been named Charlotte, N. C., district manager for the industrial products division of The Goodyear Tire & Rubber Co., Akron, O., succeeding **R. J. Ario,** who was promoted to manager of the division's Cleveland district.

Witzel Studio

F. W. Hannsgen

News Briefs

Farrel-Birmingham Co., Inc., Ansonia, Conn., has moved its Chicago, Ill., office to 10725 South Western Ave.

The Firestone Tire & Rubber Co.'s New Bedford, Mass., defense products division has been awarded a $5,680,000 contract by the Boston Ordnance District for production of 155-mm. artillery shells.

Pennsylvania Salt Mfg. Co., Philadelphia, Pa., is expanding its chlor-caustic facilities at its Calvert City, Ky., works, to boost chlorine production from 50 to 150 tons a day.

M. W. Kellogg Co., New York, N. Y., has purchased a tract of land in the Houston, Tex., Ship Channel area for construction of a polyolefin plastics plant.

B. F. Goodrich Chemical Co., Akron, O., has moved its New York, N. Y., sales office to 415 Madison Ave.

El Monte Rubber Corp., El Monte, Calif., formerly RBI Rubber Division of Record Biscuit, Inc., has begun operations.

Stoner Rubber Co., Anaheim, Calif., has announced an expansion program to include 12,000 square feet of additional production floor space.

Koppers Co., Inc., Pittsburgh, Pa., has purchased the controlling interest in Durethene Corp., Cicero, Ill., producer of polyethylene film, and will operate the firm as a partially owned subsidiary.

United States Rubber Co., New York, N. Y., has opened a new branch sales office and warehouse in the Bond Hill district of Cincinnati, O.

Anaconda Wire & Cable Co., New York, N. Y., is installing extensive equipment for the production of paper-insulated, lead-covered telephone cable. Production is scheduled for late 1956.

Avery Adhesive Label Co., Monrovia, Calif., will add 19,200 square feet of floor space to its plant for an office, laboratory, and warehouse. The cost of the project is estimated at $180,000.

Franklin C. Wolfe Co., Culver City, Calif., has completed its new 60,000-square-foot plant and has installed such equipment as a 60-inch mill, two 30-inch mills, and new laboratory facilities.

Goodrich-Gulf Chemicals, Inc., Cleveland, O., has revealed that its Institute, W. Va., synthetic rubber plant now has one of three production lines in operation. The plant, which has a rated capacity of 122,000 long tons of rubber annually, had been idle since 1953, when it was government-owned.

Phillips Chemical Co., rubber chemicals division, has moved its western district sales office to 111 York St., Elmhurst, Ill.

The Dayton Rubber Co., Dayton, O., has instituted a formal course on general and company economics for 150 of its in-plant supervisors.

Merck & Co., Inc., chemical division, Rahway, N. J., is making its hexamine available in two grades: technical granular packed in 80-pound bags; and technical powder grade packed in 60-pound bags. Hexamine is a curing agent for synthetic rubber.

Lion Oil Co., division of Monsanto Chemical Co., has won the General Managers' Trophy for establishing a new company safety record at its El Dorado, Ark., chemical plant by operating more than 5,373,400 accident-free manhours. The plant employs 825 people.

Wellco-Ro-Search, Waynesville, N. C., reveals that its affiliated footwear manufacturing firm in Guayaquil, Ecuador, has begun production of 2,000 pairs of Wellco footwear a day at the new $270,000 plant there.

Stauffer Chemical Co., New York, N. Y., is expanding and modernizing its Niagara Falls, N. Y., plant where caustic soda, chlorinated solvents, silicon tetrachloride, and other products are manufactured. Estimated cost of the program is $1,000,000.

The Goodyear Tire & Rubber Co., industrial products division, Akron, O., has established a new San Francisco, Calif., district office with H. L. Narwitz as manager, who will continue to manage also the division's Portland, Oreg., district.

Evans Chemetics, Inc., New York, N. Y., has reduced the price of its alpha-monothioglycerol, a reducing agent and plastics stabilizer for acrylonitrile polymers, to $2.30 a pound in large quantities.

M. W. Kellogg Co., New York, N. Y., has established a western regional sales office in the Russ Bldg., San Francisco, Calif. William R. Dunn has been named manager, and Paul S. Jones his assistant.

United States Rubber Co., New York, N. Y., has appointed J. T. Meehan Co., Philadelphia, Pa., distributor of its power transmission belts in the Delaware Valley area.

Borden Co., New York, N. Y., has doubled the warehouse capacity of the Philadelphia, Pa., plant of its Durite products department. Production area will also be enlarged there.

Financial

Allied Chemical & Dye Corp., New York, N. Y. First three months, 1956: net earnings, $12,737,852, equal to $1.32 a share, against $11,708,486, or $1.22 a share, a year earlier.

American Cyanamid Co., New York, N. Y., and subsidiaries. First quarter, 1956: net profit, $11,208,882, equal to $1.17 each on 9,290,696 common shares, compared with $9,453,616, or 99¢ each on 8,728,810 shares, in the 1955 period; net sales, $118,286,222, against $111,643,065.

Anaconda Wire & Cable Co., New York, N. Y. For 1955: net earnings, $7,015,496, equal to $8.31 a share, compared with $4,700,215, or $5.57 a share, the year before.

Armstrong Cork Co., Lancaster, Pa. Three months ended March 31, 1956: net income, $3,698,000, equal to 72¢ a share, against $3,286,000, or 64¢ a share, in the 1955 months.

Belden Mfg. Co., Chicago, Ill. For 1955: net income, $1,582,203, equal to $4.09 a share, against $1,085,361, or $3.39 a share, in 1954.

DeVilbiss Co., Toledo, O. For 1955: net profit, $1,482,616, equal to $4.01 a share, compared with $786,197, or $2.10 a share, the year before.

Diamond Alkali Co., Cleveland, O. March quarter, 1956: net earnings, $2,833,471, equal to $1.12 each on 2,465,924 common shares, compared with $1,711,107, or 67¢ a share, in the corresponding period last year; net sales, $29,856,487, against $24,471,044.

News from Abroad

Around the Rubber World

By L. Thakar

(This first of a series of three on-the-spot reports on the rubber industry in the Far East by RW's foreign news editor covers the Indian scene. Subsequent articles will survey Malaya and Japan.)

BOMBAY, India. Upon my arrival in Bombay in early April I contacted D. S. Kulkarni, secretary of the Indian Rubber Industries' Association, and he was gracious enough to join me at my hotel that evening. He said we were to go through a rubber factory the following morning and have lunch with a journalist and an industrialist.

The Tire Problem

I asked him about recent investments of foreign and Indian capital in the industry. Without giving me a detailed account of these, he said that tire manufacturing, the major part of the Indian rubber industry, was entirely in the hands of two non-Indian concerns, Dunlop and Firestone. Also, Dunlop provides some tires sold by the local Goodyear sales organization as Goodyear products. Both companies have a similar arrangement with India Tire Co., an English firm.

The situation was perturbing enough to the Indian Government, striving as it was for some measure of industrial self-sufficiency, to set up an Indian Tariff Commission early in 1955 to investigate the tire industry. Some months later a report was issued.

It found that the technique of manufacturing tires and tubes in India was controlled by wholly or predominantly foreign-owned companies, that these firms were the only ones conducting tire manufacturing research on the sub-continent, and that they were underselling manufacturers of such other goods as camelback because of their 31¼% duty exemption on carbon black. Finally, the report charged that the companies were making large profits on their tires and suggested that prices could be lowered.

The immediate effect of the report, Mr. Kulkarni said, was the government's removing the exemption on carbon black. It also strongly recommended that the companies cut their tire prices by 19% but later reduced this to 11%. The suggestion is now being studied.

I wanted to know what the second Indian five-year plan was doing for the tire industry. Mr. Kulkarni said that the plan, begun April 1, called for an enormous increase in transport and communication facilities which was expected to result in a rise in Indian tire consumption of about 50% over the next five years. In 1954 some 800,000 tires and a similar number of tubes were in use. By 1960-61 the annual requirement is estimated at 1,150,000 tires and tubes. Bicycle tires were expected to rise from 5,500,000 units to about 6,700,000.

How were these needs to be met, I asked.

Mr. Kulkarni replied that although it seemed probable that the increased production would come from expanded facilities, the government preferred the setting up of new factories as a long-range solution. The Tariff Commission itself had recommended establishment of a pilot plant and offering financial assistance to Indian industrialists to induce them to enter the tire field, either independently or in collaboration with foreign concerns under mutually profitable conditions.

Other Rubber Products

The next morning my guide took me to the Korula Rubber Co. plant, there in Bombay. Started 20 years ago, the firm now makes more than 100 parts for automotive use, including foam rubber seating, as well as such varied products as bottle nipples, mechanics gloves, knee boots, and insulated wire.

Managed by Thomas Korula, it is a small factory by American standards, but considered medium sized by the Indians themselves. Walking through it, I was astonished at the large number of workers employed, but my surprise was only momentary. Although from our viewpoint it may seem inefficient to use so many people for every machine in operation, the human hand is a cheaper instrument of production than the machine in India.

Everywhere at Korula men and women took the place of machines. I saw strips of rubber being hand-cut into squares and fitted into small molds to form caps for penicillin containers. In the armored hose section men were holding down hose while it was being mechanically wrapped with wire. I saw latex foam being mixed, poured, transferred, smoothed, and cured with a minimum of equipment.

An air of improvisation pervaded the plant. In the section devoted to the proofing of fabric, I saw a worker squatting under the only machine, stretching the fabric to be proofed as it came off the rolls. Something had gone wrong with the tensioning equipment, and he was functioning in its place.

Footwear

Later at lunch I met K. M. Philip, editor of *Rubber India*, the official organ of the Indian Rubber Industries' Association. A Mr. Rai, who manufactures rubber footwear, was also present. I had been told that he is expected to be the next president of the Association.

Mr. Rai logically began the discussion with an appraisal of his own industry. He proudly pointed to the increase in the production of rubber footwear in India from 14,400,000 pairs in 1946 to 35,000,000 pairs last year. The export trade was very good except for the recent encroachment of Japanese and Hong Kong products. He admitted that Hong Kong workers were more productive than Indians, but said he was being undersold because of the lower prevailing wages in the British Crown Colony. The manufacture of rubber-soled canvas footwear in Hong Kong was mostly a cottage industry, he explained, with contractors supplying the parts, and entire families assembling them in their homes.

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Malaya

Union Threatens Strike If Wage Cut Is Carried Out

The National Union of Plantation Workers issued a thinly veiled threat of strike to the Malayan Planting Industries Employment Association in early April if the planters group went ahead with its announced intention of further reducing the wages of Malaya's 250,000 estate workers.

The lower wage level would cover the April-June period and would be based, according to contractual agreement, on the recent fall of natural rubber prices to below $1 (Straits). Union leaders say the proposed wage cut would not give workers an adequate standard of living and call for cancellation of the wage-price tie-in.

During the January-March quarter, when wage rates were based on the average rubber price of $1.20-$1.30 a pound, contract tappers were earning $3.75 a day, checkroll tappers $3.15, and field workers $2.50.

Union leaders now call for a basic wage of $6 a day for contract tappers, $5.25 for checkroll tappers, and $4.50 for field workers. The MPIEA plans to go ahead with the wage-price tie-in arrangement, paring wages down to $3.35, $2.85, and $2.30 a day, respectively, for the April-June period.

MPIEA spokesmen have declared that if union demands were met, about $200,000,000 would be added to the industry's wage bill. The industry is already seen to be staggering under heavy taxation, declining rubber prices, and a falling market due to increasing competition from synthetic rubber.

In suggesting that arbitration could settle the dispute, the MPIEA was credited with greater willingness to arrive at a peaceful solution than union leaders, who have so far remained adamant in their demands.

POLYSAR can help to solve your rubber problems.

Why?

Because Polysar's quality, uniformity and customer service plus the wide variety of Polysar types enable you to select the best rubber for the job.

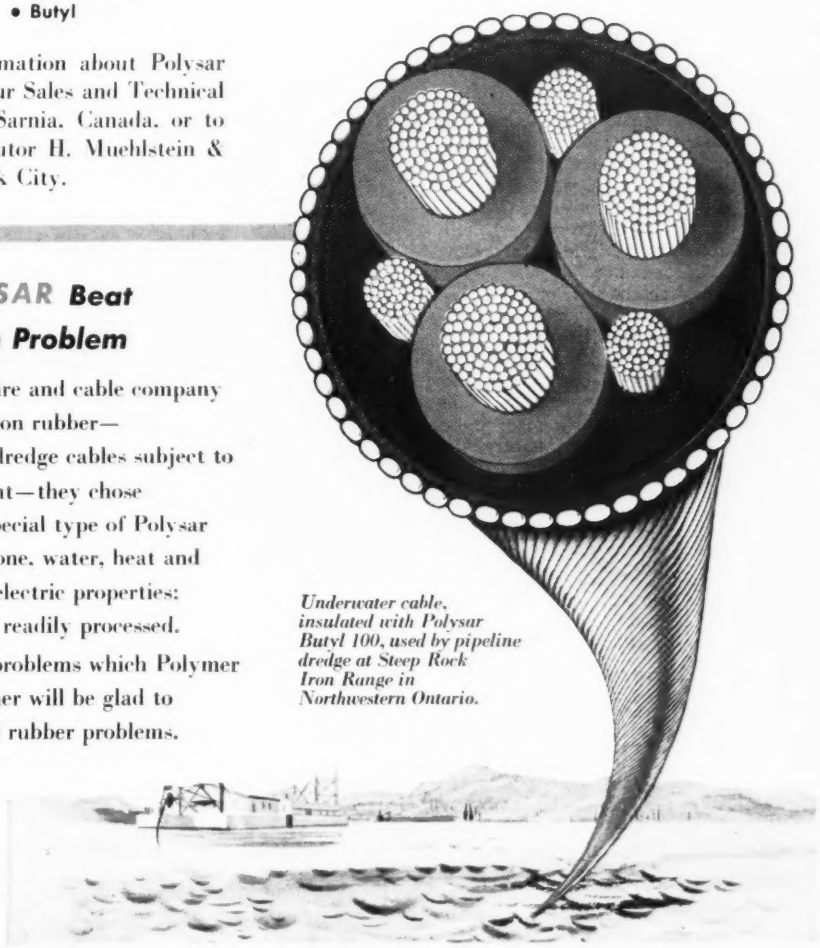
Polysar is available in the following types:

- General Purpose
- Special Purpose
- Latices
- Oil-resistant
- Butyl

For detailed information about Polysar rubbers write to our Sales and Technical Service Division, Sarnia, Canada, or to our U.S.A. distributor H. Muehlstein & Co. Inc., New York City.

Here's How POLYSAR Beat a Critical Insulation Problem

When a large Canadian wire and cable company was looking for an insulation rubber—to be used in underwater dredge cables subject to extremely rugged treatment—they chose Polysar Butyl 100. This special type of Polysar gives high resistance to ozone, water, heat and cold; provides excellent dielectric properties; has good flexibility, and is readily processed. This is only one of many problems which Polymer has helped to solve. Polymer will be glad to help you with your critical rubber problems.



Underwater cable, insulated with Polysar Butyl 100, used by pipeline dredge at Steep Rock Iron Range in Northwestern Ontario.

POLYMER CORPORATION LIMITED SARNIA CANADA
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Union spokesmen have said that food rations for a worker, his wife, and two children now cost about $4.40 a day and that improvement in the standard of living of the estate worker has lagged behind labor in other Malayan industries.

The rubber manufacturers told their Malayan critics that synthetic rubber was a vital necessity for their business and said, in effect, that it was here to stay.

The delegation consisted of L. J. W. Bailey, Dunlop Rubber Co., Ltd.; Stuart Covell, director of the Federation of British Rubber & Allied Manufacturers Associations; H. G. Chichester-Miles, Empire Rubber Co., Ltd.; Maurice Baker, Firestone Tire & Rubber Co., Ltd.; and R. E. Gillis, Goodyear Tire & Rubber Co., Ltd.

They represented 98% of the British rubber manufacturing industry, which employs 200,000 workers in 420 factories.

Blackman Surveys Industry

Geoffrey E. Blackman, professor of rural economy at Oxford University, has conducted a two-week initial survey of the industry as chairman of a committee set up by the Rubber Producers' Council to frame a long-term program of research and development in an effort to meet the growing encroachment of synthetic rubber.

The program is intended to stimulate research on the rubber tree, on the raw product, and on the development of end-products. Mr. Blackman, who is also director of Britain's Agricultural Research Council Unit of Experimental Agronomy, is expected to return to Malaya in July with the rest of his committee.

The last research and development plan of the industry was put into effect in 1948 and ran for five years. The Rubber Producers' Council has called upon the home government to share the cost of the new development program.

Mr. Blackman said that the main problem facing the natural rubber industry was to find cheaper and more efficient methods of production. He refused to comment, however, on the eventual outcome of the "war" between natural and synthetic rubber.

Attacks Synthetic Imports

The president of the Penang Rubber Trade Association, Heah Joo Seang, has called upon the British Government to halt the importation of American synthetic rubber and to lift the embargo on natural rubber exports to Red China.

He said that the continued importation of rubber from the United States would be a millstone on the natural rubber industry and would force prices down. He also urged Britain to limit its use of the synthetic product to the 70,000 tons it expects to import next year.

He ridiculed the effectiveness of the United Nations embargo to Red China, pointing out that Malayan rubber was making its way there now through Indonesian, Burmese, and Ceylonese ports. The embargo was needlessly strangulating the Malayan economy, he asserted.

Britons Seen Reluctant to Embark on Estate Career

British young men are becoming increasingly reluctant to come to Malaya for jobs in the rubber growing industry because they believe they may not be allowed to carry on their career after the country is granted its independence, an industry spokesman revealed at Kuala Lumpur following an announcement of new terms of employment for planters.

"Even when the emergency was at its height, it was easier to get men than it is now," he declared. "In the past, a man could look forward to spending all his working life in Malaya, but to many now the future is in doubt."

The new employment terms provide for companies to incorporate at least half of the planter's cost-of-living allowance into his basic salary. This plan would give him the advantages of the provident fund, assuring him that he will receive the extra amount when he goes on leave.

The spokesman said, however, young Britons were asking themselves if natural rubber can compete with synthetic, if rubber growing concerns can continue to bear up under excessive taxation, and whether they can be assured of at least a 30-year career in Malaya.

The spokesman implied that it was becoming increasingly difficult to answer all three questions in the affirmative, particularly the last.

U. K. Mission Urges Lower Rubber Prices, Good Will

Representatives of the British rubber manufacturing industry, on a two-day visit to Malaya in mid-April, warned natural rubber producers that synthetic rubber production in the United Kingdom would be increased unless natural rubber producers lowered their prices and showed more understanding of the problems facing rubber manufacturers.

The visit was the first ever paid by a group of British rubber industry leaders. Essentially a good-will mission, it was intended to allay the fears of Malayan producers about the import of synthetic rubber into Britain from the United States and of the impending production of synthetic rubber in England.

Discuss Buyers' Complaints

The number of complaints from abroad about rubber purchased in Malaya increased last year, the annual report of the Malayan Rubber Export Registration Board has revealed.

The report, issued in April, puts the total number of complaints received in 1955 at 65, of which 39 came from the Rubber Trade Association of London, 23 from the Rubber Trade Association of Japan, two from shippers in Singapore, and one from a buyer in London.

Formed in 1953, the board is the watchdog of the Malayan industry's good name and enforces agreed standards of packing on Malayan rubber shippers. The 1955 complaints resulted in 13 packers being fined. Twenty more cases are pending.

The report says, however, that many of the claims made by buyers in London and New York were unreasonable and excessive, and others were unfounded.

The report also discussed the problem of skim rubber, a by-product of the preparation of latex, which has a deteriorating effect if packed in bales of ordinary rubber. It was said that the responsibility of including skim rubber in any consignment of rubber still rests with the packer. The board decided to take no action to control the disposal of skim rubber unless an international control could be effected.

•

Vietnam

A scheme to divert Vietnam rubber from the United States to France by a special bonus of 10 francs per kilo, which the French Government will pay Vietnam growers, reportedly went into effect in the beginning of last November. French rubber importers will have to reexport 10% of the Indo-China rubber to the dollar area or to countries belonging to the European Payments Union. By buying rubber from Indo-China which can be paid for in francs, France will not only be able to save the considerable amounts in sterling required to pay for rubber from the sterling area, but will also be able to reduce her payments surplus with Vietnam which has been hampering the French export trade.

In 1954, Vietnam exported 54,212 tons of rubber, of which 35,552 tons went to the United States and 12,301 tons to France; total imports by France in that year came to 124,996 tons, of which Malaya supplied 87,684 tons.

A report from Saigon states that 25,000 Vietnam rubber workers went on strike on November 10, demanding a 100% increase in pay; planters have offered an increase of 20%.

•

East Germany

Under the Second Five-Year Plan the VEB Chemische Werke Buna, of Schkopau, will increase total output of its various products by 15 to 20%; synthetic rubber alone is scheduled to show a rise of 20% by 1960. At the same time more than 30,000,000 DM will be made available for research, especially to raise the output of polyvinyl and chloride to develop an impact-resistant polystyrene plastic.

This concern is understood to have exhibited various types of Buna-type rubber and plastics at the Dusseldorf Fair in West Germany, October 8-16, 1955, among others—Buna S4/T, a cold rubber; Buna SO, oil-plasticized rubbers with varying oil content; plasticized Perbunan W; Chlorbuna M, a bonding agent for corrosion-resistant coatings; Bunalatex S3, a butadiene-styrene latex (about 35%) for adhesives and finishes for artificial leather and textiles.

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An Ozonator for Accelerated Testing of Rubber (Bulletin 36); A Method for Classifying Oils Used in Oil-Extended Rubbers; Circosol-2XH, Sundex-53 (Bulletin 14); Processing Natural Rubber and Synthetic Polymers; Sundex-41; Sundex-53 (Bulletin 18); Sunoco Anti-Chek (Bulletin 30).

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Great Britain

Dunlop Advances Trevaskis, Murphy in Research Posts

E. A. Murphy, general development manager at the research center of Dunlop Rubber Co., Ltd., Fort Dunlop, Birmingham, England, has been appointed director of research in charge of the firm's central research division. Also advanced was Henry Trevaskis, director of Dunlop Rib & Wheel Co., Ltd., who becomes director of development at Fort Dunlop.

Mr. Murphy, chief of the team of research chemists who founded the British latex foam rubber industry 28 years ago, is a winner of the Colwyn Medal of the Institution of the Rubber Industry. He was a key figure in the investigation of synthetic rubber production possibilities during World War II and is currently on the board of the recently formed International Synthetic Rubber Co.

Mr. Trevaskis, who developed the gun-firing controls used in British fighter aircraft since 1937, is the chief designer in the company's aviation division. He is credited with 208 patented inventions since joining Dunlop 30 years ago. These are in the field of cycle rims, road wheels, aircraft wheel and braking systems, and pneumatic controls.

Henry Trevaskis

E. A. Murphy

British Abstract Codings

A revised edition of its "Systematic Classification of Scientific, Technological, and Commercial Information on Rubber" has been issued by the intelligence division of the Research Association of British Rubber Manufacturers, Shawbury, Shropshire, England.

The publication is a detailed classification of abstracts of books, journal articles, patents, and miscellaneous information on rubber. An abridged version of the coding system for smaller users who do not need the fine subdivisions of the detailed tables is included in the appendix.

Edited by P. C. C. Graham, the publication is listed as information bureau circular No. 430.

Plan Two Butadiene Plants

Two butadiene plants will be built on the site of the Esso oil refinery at Fawley, near Southampton, providing butadiene for the synthetic rubber plant being constructed by Dunlop nearby. The three new plants, expected to be in operation by 1958, will together turn out about 50,000 tons of synthetic rubber annually, almost eliminating the necessity of importing rubber from the United States, according to reports.

Correction

Pirelli, Ltd., London, England, has made the following comment on an item entitled, "Pirelli Expansion Plans," which appeared on page 706 of our February, 1956 issue:

"We wish to point out that Pirelli, Ltd., is not affiliated with Wellco-Ro-Search, but we have an arrangement with Ro-Search whereby they give us technical guidance in the manufacture of rubber footwear.

"Moreover, the extension of our factory buildings at Burton-on-Trent is to provide increased production capacity for pneumatic tires and footwear, and not solely for footwear as the article implies."

•

Netherlands

Communication No. 231, of Rubber Stichting, Delft, compares the properties of the anti-ager Styphen I in white and light-colored mixes with those of AgeRite Alba, 'Flectol H,[2] and phenyl-beta-naphthylamine. Styphen I, a styrene-phenol condensation product, is a water-clear, pale yellow, viscous ffuid, insoluble in water, that can be mixed with the usual rubber solvents in all proportions; some precaution is required in handling it.

Sample mixes containing Styphen and the above anti-agers were aged in the Geer oven four to eight weeks. A comparison of the changes in properties indicated that Styphen acts most like AgeRite Alba; both products gave the same Shore hardness and tensile strength after eight weeks' aging; modulus at 500% elongation was approximately the same also. Styphen proved only slightly less effective than PBN and Flectol H. It is used in the proportion of 0.5-part to 100 parts of rubber (by weight); higher concentrations had no significant effect.

After irradiation for 24 hours with ultraviolet light, the samples containing Styphen I and AgeRite Alba were slightly yellowed; the same result followed in the case of light-colored samples containing I.C.I. Vulcafor fast colors.

[1] R. T. Vanderbilt, Co., New York, N. Y.
[2] Monsanto Chemical Co., rubber chemicals department, Akron, O.

•

Rumania

According to recent reports, Rumania plans a petroleum-based synthetic rubber industry. At Ploesti, one of the nation's most important oil centers, a Research Institute is said to have been established which will have as its task the development of methods for making synthetic rubber, ethyl alcohol, acetone, glycerine, and other by-products from petroleum and natural gas. The Institute will also have to design factories for this new branch of Rumanian industry.

•

Chile

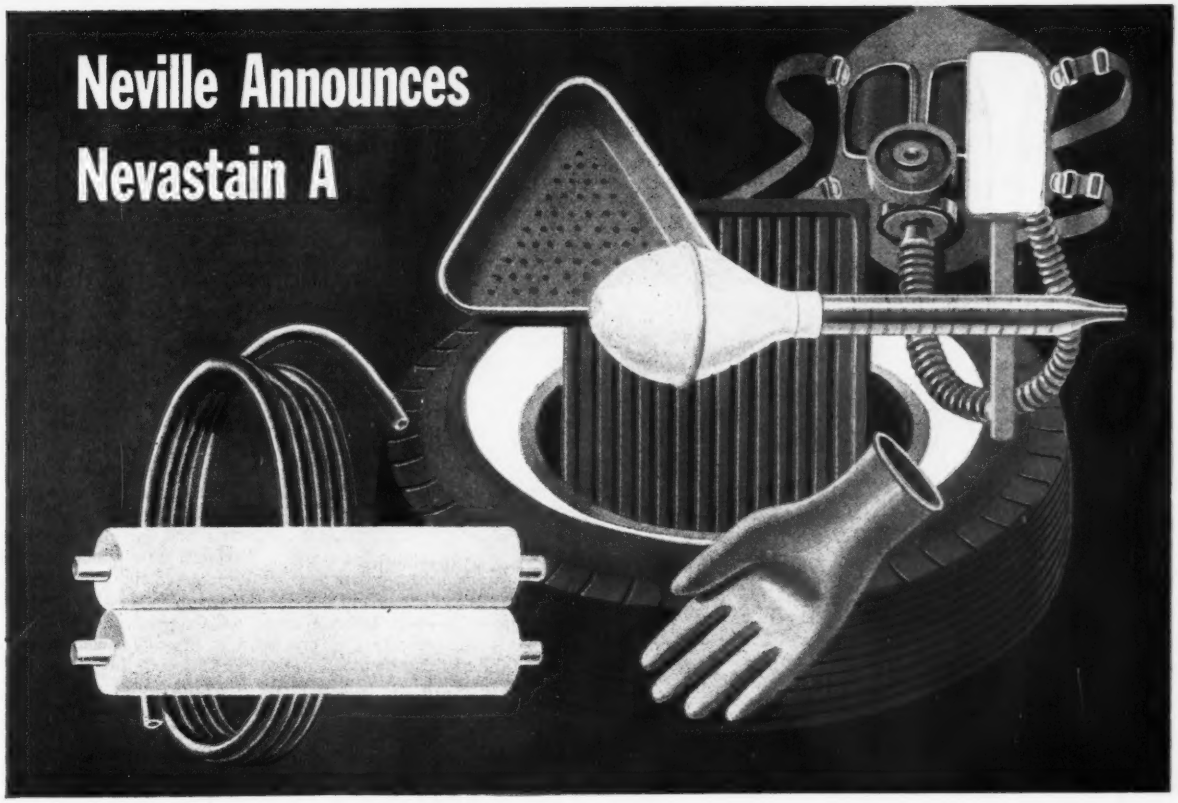
The rubber manufacturing firm, Vulco Limitida—Productos de Goma, of Santiago, has been acquired by the recently incorporated company, Vulco Soc. Anonima. Under its new owners the factory will undergo considerable expansion. The products now being made include tire repair materials, rubber flooring, rubber-covered rolls, hose, packing, mechanicals, hard rubber pipes and fittings, and phenolic laminates.

•

Colombia

Productos De Caucho Villegas, S. A., the first full-scale overseas manufacturing operation of Seiberling Rubber Co., Akron, O., in March began production of 75,000 truck and passenger tires annually at its Bogota, Colombia, plant.

The company was formed in 1954 by Seiberling and a group of Colombian businessmen. Later, Almacen Villegas, Colombia's largest rubber flooring manufacturer, as well as a producer of footwear and tread rubber, was incorporated into it.



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NEW MATERIALS

Thiokol High Absorption Polyurethane

A polyurethane prepolymer for resilient foam that is said to absorb ten times as much water as standard polyurethane foams has been announced by Thiokol Chemical Corp., Trenton, N. J. Designated ZL-239, the prepolymer can be made into foamed materials of uniform cell size and smooth texture which combine resilience and strength, both wet and dry, with water absorption properties equivalent to those of cellulosic materials, according to the company. While absorbing ten times as much water as standard polyurethane foams, ZL-239 foams swell about 40% in volume, Thiokol reports.

Suggested applications are for industrial and household sponges, mops, wiping cloths, and other products. The prepolymer is packaged as a three-component mix to assure stability: an emulsifier, the prepolymer, and a catalyst. The mix can be stored for three months under ambient conditions.

The prepolymer can be processed by machine or through a spray gun and can be molded into relatively complex shapes. The use of prepolymers reduces toxicity hazards and eliminates the necessity of extensive control procedures by the end-product manufacturer.

According to Thiokol, a typical foam made from ZL-239 has a tensile strength of 22 psi. and an elongation of 300%, when dry; and a tensile strength of 11 psi. and an elongation of 175%, when wet. The normal density obtained with the prepolymer is 4.5 lb./cu.ft., but lower density foams may be made.

G-E Low-Shrinkage Silicone Rubbers

Three new silicone rubber compounds said to feature the same shrinkage as organic rubbers, as well as low compression set properties without toxic additives, have been announced by the silicone products department of General Electric Co., Waterford, N. Y. Designated SE-361, SE-371, and SE-381, these Class 300 silicone compounds permit the molding of silicone rubber parts in the same molds used for organic rubber products, according to G-E, and afford the obtaining of closer tolerances because of their lower shrinkage. Fume-removing equipment is said to be no longer necessary since toxic additives are not required.

Cures as short as one hour at 300° F. often produce properties attained by other low-compression stocks only after extended curing periods, it is reported. Curing may be done by mold, hot air vulcanization, or steam-curing methods. Other advantages of the new silicone rubber compounds are said to be their ability to take Teflon[1] readily, oil resistance equal to that of old mercury stocks, low moisture absorption, and excellent processing characteristics.

Some reported physical properties of the compounds after a one-hour oven cure at 300° F. are given in the following table:

	SE-361	SE-371	SE-381
Specific gravity	1.26	1.33	1.42
Hardness, Shore A	60	70	80
Tensile strength, psi.	800	900	1,000
Elongation, %	120	90	70
Shrinkage, Linear, %	1	1	1
Compression set, Method B, %			
22 hrs./300° F.	25	30	35
350° F.	35	50	60
400° F.	70	80	90
Tear strength, Die B, lb./in.	50	50	50
Brittle point	Below −85° F.		

[1] Teflon Powder TE-6, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

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Baker Dispersion 33 Synthetic Wax

An aqueous suspension of a high melting, non-toxic synthetic wax for use as a mold release agent on heated molds or for incorporation into synthetic resin emulsions, rubber and vinyl latices, and other water-based systems has been introduced by Baker Castor Oil Co., New York, N. Y. Called Dispersion 33, the product is said to offer a convenient means of utilizing the excellent lubricity, anti-blocking and solvent resistant properties of the hard, brittle, sharp melting, and fast-setting wax which comprises 33% of it.

As a mold release agent, Dispersion 33 has proved more effective than silicone spray both in release properties and in permitting a greater number of runs, the company reports. As a compounding ingredient, it is said to impart anti-blocking, anti-tack, and oil and solvent resistance. A third use is as an impregnant for paper, cotton, and other porous materials.

Further technical data may be obtained from the company.

X-1034R 40 Durometer Silicone Rubber

A red colored, 40 durometer, general-purpose silicone rubber compound that fully meets the requirements of Aeronautical Materials Specification 3301B has been added to the silicone rubber line of Union Carbide & Carbon Corp., silicones division, New York, N. Y. Designated X-1034R, the compound is said to have excellent resistance to high temperatures, very low compression set, and low moisture pickup, and to be easy to handle. According to the company, it is the only available silicone rubber compound that meets Specification 3301B, and fabricators can now manufacture parts to these requirements without compromising on properties or having to obtain waivers from customers.

The compound can be molded, extruded, or calendered with conventional or special catalysts. With di-tertiary-butyl peroxide (DTBP), it has been found that X-1034R can also be satisfactorily used for thick sections. Available in 25- and 50-pound cartons, the silicone rubber compound is supplied uncatalyzed so that the fabricator can select the catalyst best suited for his purpose. It will be supplied in catalyzed form, however, on request.

Some reported typical properties of X-1034R, when catalyzed with benzoyl peroxide, mold cured for 10 minutes at 250° F. and postcured for 24 hours at 480° F., are as follows:

Hardness, Shore A	40
Tensile strength, psi	750
Elongation, %	270
Tear strength, lb./in. Die B	60
Compression set, % deflection	
22 hrs. at 350° F	25
70 hrs. at 300° F	22
Low-temperature brittleness, ASTM D746	—90° F.

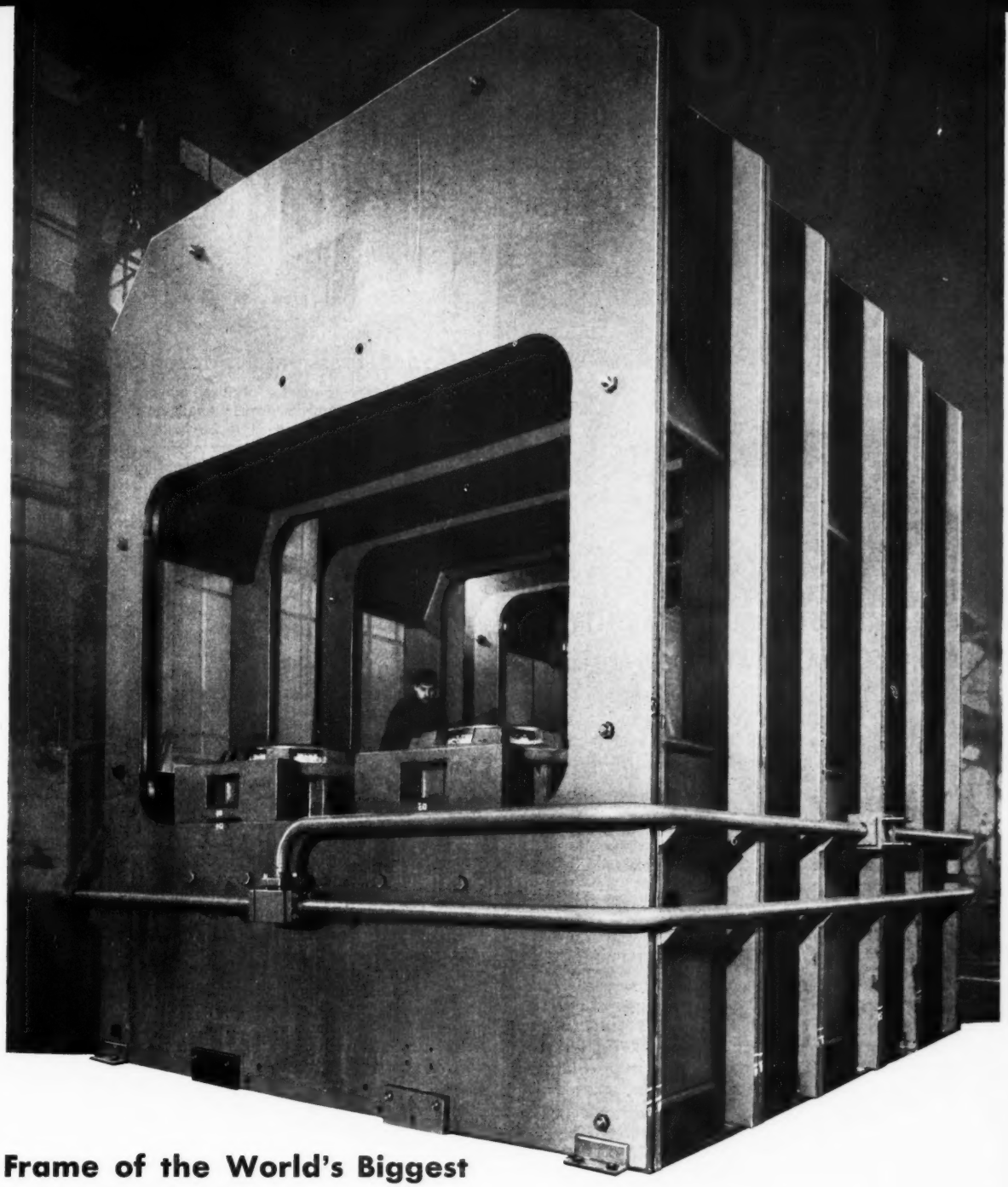
An advance technical data sheet, SF-1003, may be obtained from the company.

Brilliant Toning Red CP 1269

A non-bleeding red azo pigment, based on beta-oxy naphthoic acid, that is said to offer good heat resistance and brilliant shades in rubber and plastics compounding has been placed on the market by Sherwin-Williams Co., pigment, color, and chemical division, New York, N. Y. Called Brilliant Toning Red CP 1269, it is of the type commonly known as Red 2B, and the company claims it is the strongest non-resinated pigment of this type available. Others of its advantages, according to Sherwin-Williams, are that it is easily dispersible and shows no migration, crocking, or bleeding in plasticizers, water, or solvents.

Some of its reported physical properties are as follows:

Specific gravity	1.68
Weight per solid gallon, lbs.	13.99
Bulking value, gal./lb.	0.0715
Oil absorption	44.0



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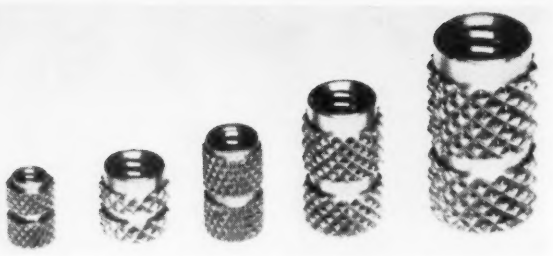

Standard Inserts for Plastic Molding

Threaded Brass Inserts for Molded Items

Threaded brass inserts for plastics, rubber, die castings, and potting compounds are being made available by Standard Insert Co., Pacoima, Calif. Designed to be molded directly into the product and requiring no secondary operations for inserting or locking, the inserts are knurled to prevent rotation, with additional strength against pullout obtained through two circular relief bands on each insert.

The inserts are available in sizes from #2 to ⅜-inch in all regular thread sizes, both NC and NF, and in two series, tapped straight through and blind. Steel or aluminum inserts may be ordered as well.

RC Plasticizers D-31, DIDP-10

Two new plasticizers have been introduced by the latex and chemical division of Rubber Corp. of America, Hicksville, N. Y. Called RC Plasticizer D-31 and RC Plasticizer DIDP-10, they are both clear liquids with an APHA color of 100 maximum and a mild odor.

D-31, a blend of di-isodecyl phthalate and di-isodecyl adipate having an average molecular weight of 441, is said to function as an economical low-temperature plasticizer for polyvinyl chloride. D-31 exhibits lower volatility, reduced water sensitivity, and better heat stability compared to blends of the more common dioctyl phthalate and adipate, according to the company. In certain applications it is said to have been successfully used as a replacement for normal octyl decyl phthalate.

DIDP-10, a modification of the firm's DIDP plasticizer, has an average molecular weight of 438 and is said to have been specifically designed to improve low-temperature brittle points in polyvinyl chloride compounds while maintaining the low volatility characteristic of the higher phthalate esters. As a primary plasticizer, it has excellent aging qualities, it is claimed, as well as resistance to extraction by soapy water, and a desirably low specific gravity.

Suggested uses are in films, hose, floor tile, plastisols, outerwear, and upholstery.

Some typical properties of the two materials have been reported as follows:

	D-31	DIDP-10
Specific gravity, 20/20° C.	0.954	0.955
Mid-boiling point @ 5 mm. Hg	253° C.	259° C.
Flash point	420° F.	425° F.
Viscosity @ 25° C.	64 cps.	73 cps.
Surface tension @ 25° C.	32 dynes/cm.	33 dynes/cm.
Saponification No.	254	241

Teflon-Coated Aluminum Foil—Amfoil

Aluminum foil coated on one or both sides with a continuous film of Teflon (polytetrafluoroethylene) for use as insulation in sub-miniature capacitors, coil forms, transformers, and shielding has been developed by American Machine & Foundry Co., New York, N. Y. Trade marked Amfoil, the new material has a Teflon coating varying in thickness from 0.03- to 0.5-mil per side. Thickness of the aluminum varies from 0.2 to 2.0 mils. The foil

(*Continued on page 302*)

NEW

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New Plastolein 9404 TGP (triethylene glycol dipelargonate) offers superior performance in synthetic rubbers. Yet it *costs less* than commonly used low-temperature plasticizers.

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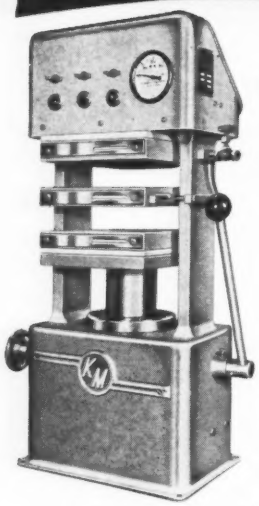

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- 200-600° F. Temp. Range
- Dual Voltage Platens

For complete details write:

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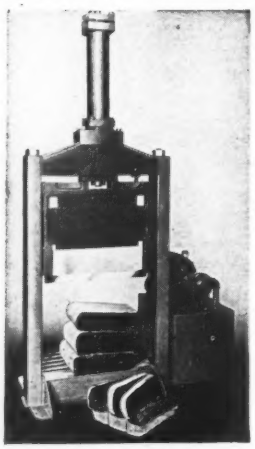
RUBBER BALE CUTTER



A moderately priced machine, simple in design and economical in operation, that fully meets all requirements. Hydraulically operated and completely self-contained. The heavy-duty knife will cut a full 29-inch width (opening is 23 inches high). Bales can be cut to minimum 1-inch slabs. Bales are easily advanced for cutting as they rest on ball-bearing rollers. Only one operator is required and built-in controls provide safe operation.

SPADONE Cutters will give years of satisfactory service and large production is assured. Furnished completely assembled and ready for operation. Write for complete information.

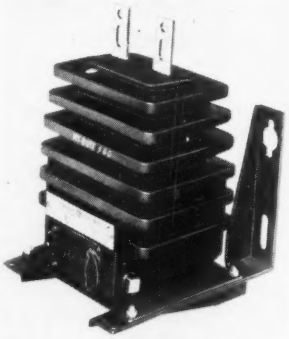
SPADONE MACHINE CO. INC.

SOUTH NORWALK, CONN. PHONE: VOlunteer 6-3394

NEW EQUIPMENT

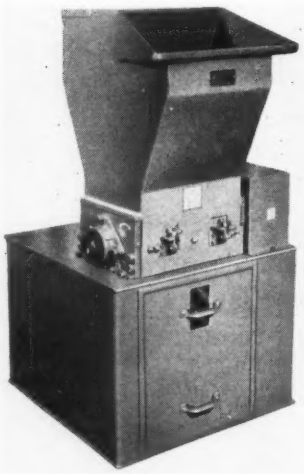
Hy-Bute/60 Insulated Current Transformer

The first high-voltage current transformer to be molded with Hy-Bute/60 insulation, a butyl rubber compound strengthened by a chemical mechanism that prevents the formation of free carbon, due to high-voltage discharges on the surface, has been introduced by General Electric Co., Schenectady, N. Y. Designated JKW-5, the current transformer is designed for outdoor metering and relaying applications and has a capacity of 15,000 volts. It can be mounted vertically, horizontally, or inverted to place the primary terminals in any desired position, according to the company. This transformer, furthermore, is said to be smaller and lighter than previous models, to require far less maintenance, and to be not susceptible to mechanical damage.



G-E's Type JKW-5 current transformer

All-Steel Plastic Grinder



Marvel Line Granulator M-300

An all-steel plastic grinder with a capacity of up to 400 pounds an hour is being offered by Ball & Jewell, Inc., Brooklyn, N. Y. Designated M-300, the grinder, third in the company's series of Marvel Line Granulators, has an 8- by 16-inch throat opening that accommodates large area rejects, as well as sprues and runners, and is available with a 7½- or 10-hp. motor.

A double-shear knife action assures cutting and grinding without fluffing, the company says, with both hot and cold sprues capable of being fed simultaneously. Hand clamps provide for locking of the hopper to the machine. A sight glass reveals when the hopper has been filled.

Oakes Model 8M Latex Foam Mixer

A smaller version of its continuous automatic mixer for the manufacture of latex foam rubber has been made available by E. T. Oakes Corp., Islip, Long Island, N. Y. Designated Model 8M, the unit has a capacity of 50-450 pounds of latex foam an hour and is said to be provided with the same equipment as the larger models, including proportioning pumps for zinc and gel. The mixer, designed for the small producer, can also be used in research laboratories and pilot plants on a wide variety of materials, according to Oakes. The Model 8M can be bought or leased.

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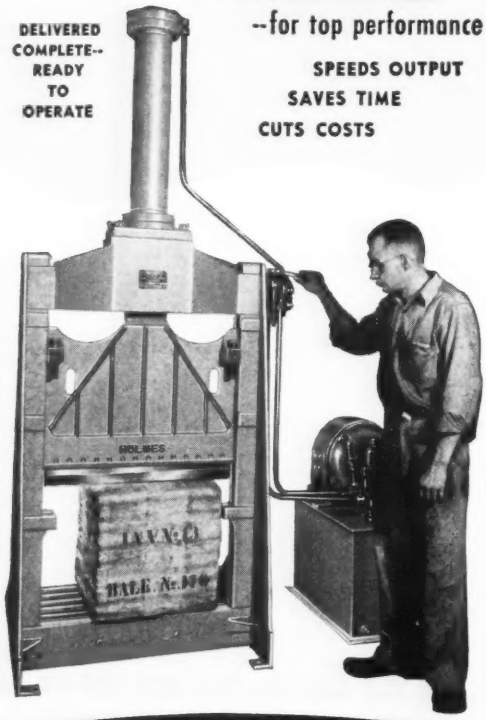

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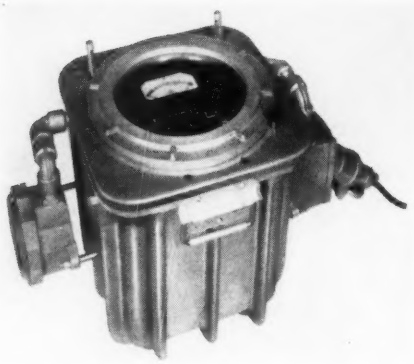
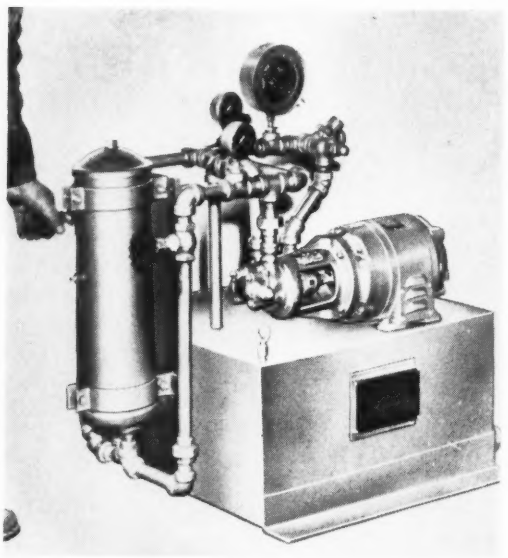


Davis portable gas alarm system

Combustible Gas Analyzer and Alarm

A self-contained portable analyzer and alarm mechanism for combustible gases has been placed on the market by Davis Instruments, division of Davis Emergency Equipment Co., Inc., Newark, N. J. The Davis portable explosion-proof combustible gas alarm system, as it is known, has such features as an inside-mounted motor-driven pump, visual and audible signals, and a meter calibrated from zero to the lower explosive limit that shows gas or vapor concentration continuously.

Operating power of the unit is 110-volt, 60 cycles, single-phase, 100 watts.



Bowser 'CS' System

Circulating Lubrication Systems

A line of circulating lubrication systems for providing continuous recirculation of filtered oil to bearing surfaces of light, medium, and heavy-duty machinery has been placed on the market by Bowser Technical Refrigeration, division of Bowser, Inc., Terryville, Conn. Dubbed the 'CS' System, it is furnished as a complete unit consisting of circulating pump, tank, filter, cooler, and necessary piping. The equipment prevents oil breakdown and the development of sludge and harmful deposits, the company says, and insures against "down-time" production losses, saving on bearing repair or replacement.

The 'CS' System is available in 18 models, ranging in tank capacity from 25 to 100 gallons. The smallest model has overall dimensions of 28 by 28 by 29 inches; the largest, 64 by 34 by 75 inches.

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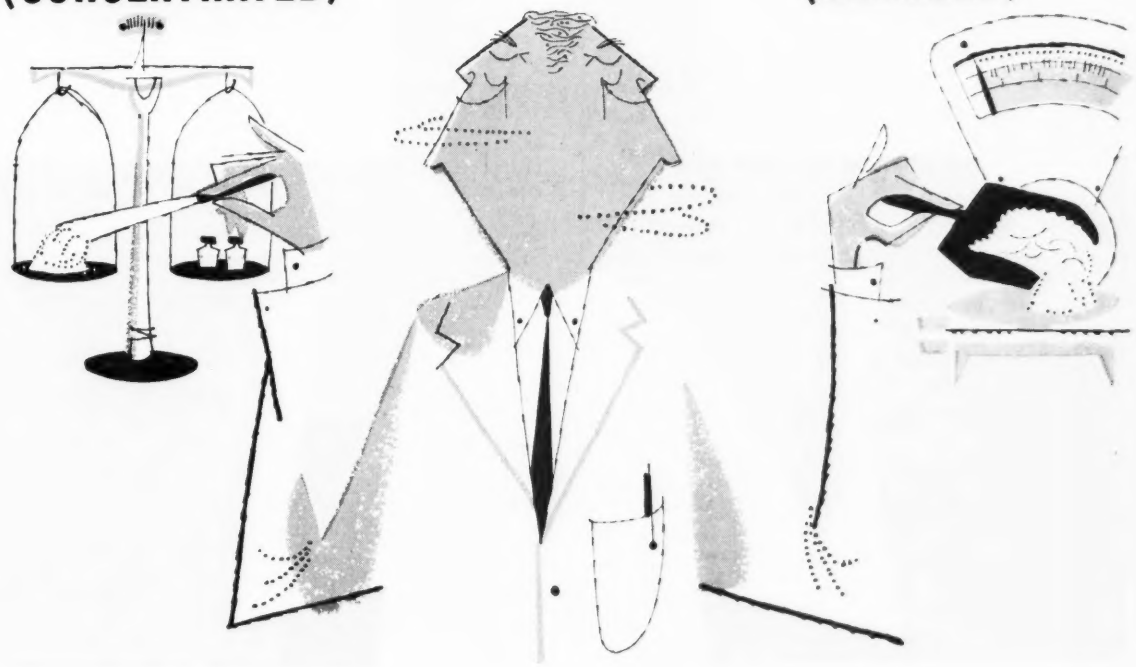

You can achieve reductions of as much as 30% in your milling cycles — and get good plasticity in natural rubber —with small quantities of PEPTON 65, Cyanamid's newest concentrated plasticizer.

Or if you prefer it in blended form, Cyanamid offers PEPTON 65-B. This blend features improved resistance to caking, better dispersion and less tendency to dust. Both are available in semi-commercial quantities, and samples are offered for trial evaluation through your Cyanamid representative.

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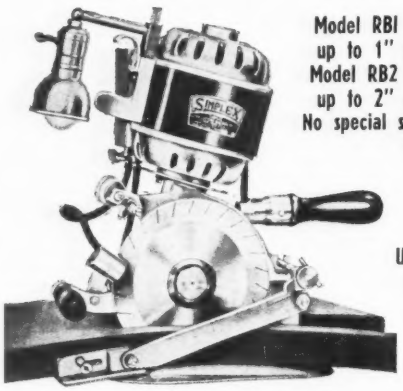

Model RB1 for material up to 1" in thickness. Model RB2 for material up to 2" in thickness. No special skill required to operate.

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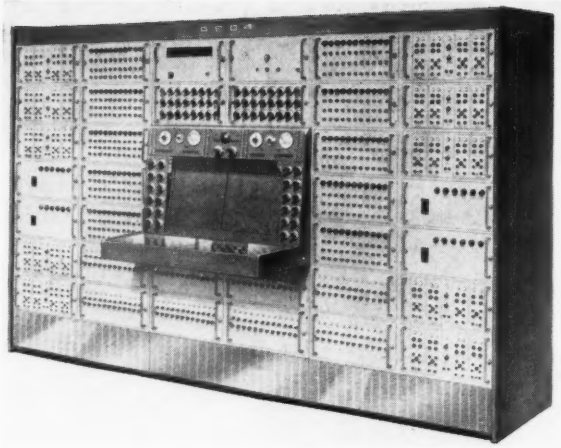
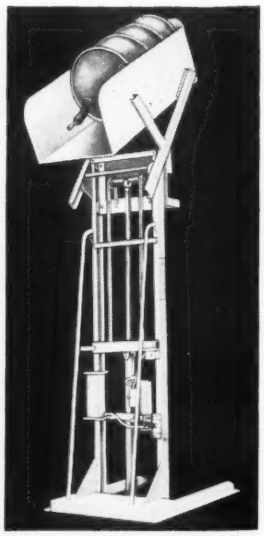


GEDA A14 analog computer

New Goodyear Analog Computer

A new analog computer, said to combine practically unlimited linear and non-linear computing capabilities with highest accuracy, greatest flexibility, and simplified operation, has been added to the computer line of Goodyear Aircraft Corp., Akron, O. Designated GEDA A14, it has such features as a built-in problem analyzer that checks the wiring of a problem and the accuracy of coefficients during and after the set-up procedure; an automatic dialing system for all selection and monitoring operations; built-in circuits that simplify the reading out of answers to extreme accuracies; stabilized electronic map readers for function of two variables; and variable-delay transport-lag simulators.

According to the company, in the single-console configuration type, up to 96 operational amplifiers and 50 or more non-linear elements can be accommodated, providing one complete computing system or two independent smaller systems for widest flexibility. Multi-console systems provide larger capacities.



Uhrden's Tubar Hi-Dump

New Hydraulic Dumper

A hydraulic dumper designed to elevate loads up to 750 pounds for dumping heights in excess of 60 inches has been placed on the market by Uhrden, Inc., Dennison, O. The Tubar Hi-Dump, as it is known, has an overall length of 54 inches, an overall width of 42 inches, and an overall height with load raised of 48 inches plus the dumping height.

Said to be adaptable to a wide range of industrial applications, the dumper is available in portable or permanent models and is equipped with telescopic or straight mast. It can be powered with a 12-volt automotive battery or a plug-in electric motor. The unit can be supplied with a stainless steel chute and explosion- or splash-proof power.

"Precision-Dow Dual Recordomatic Titrometer." Bulletin No. 640B. Precision Scientific Co., Chicago, Ill. 8 pages. Specifications, applications, and operation of the company's automatic feed recording titrometer are contained in this illustrated publication.

SILASTIC GUMS help your research men turn the wheels of progress

Here's the first silicone rubber tire ever produced. Built in cooperation with Dow Corning by a group of rubber research and development engineers, this tire was designed to explore another area of potential usefulness for Silastic.* Such studies become more urgent as design engineers find an increasing need for rubbery materials that retain good physical and dielectric properties in service at temperatures above 200 F. Looking toward future developments in tires, mechanical rubber parts or electrical insulating systems, you'll find that Dow Corning is your best source of silicone rubber research materials and technical assistance. We offer your research men sample quantities of the most complete line of silicone gums available — sulfur vulcanizing, peroxide vulcanizing and fluid types.

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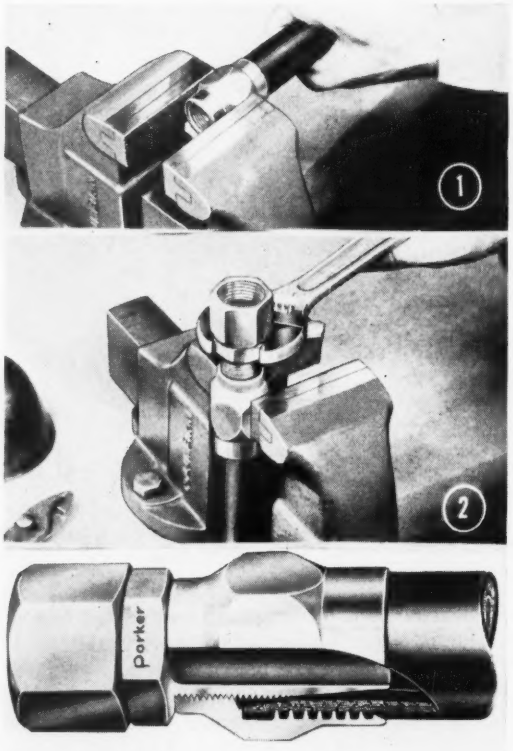
NEW PRODUCTS



Installation of Hoze-lok fittings: (top) hose twisted counterclockwise into socket; (center) nipple screwed clockwise into hose and socket. Cutaway view of fitting (bottom) shows how socket thread grips hose to wire braid

Fitting for Wire Braided Hose

A "no-skive" type of reusable fitting for hydraulic hose assemblies made up of rubber-covered wire braid hose has been made available by Parker Appliance Co., Cleveland, O. Called Hoze-lok, the fitting consists of steel socket and nipple, designed so that the hose cover need not be stripped off. The lead thread of the socket cuts through the rubber cover of the hose, allowing the following threads to engage the wire braid. The contact holds beyond hose-bursting pressure and under severe vibration, the company says.

Hoze-lok sizes available are for hose with ¼-, ⅜-, and ½-inch inside diameters and with a choice of four different connecting ends.

Goodyear Tubeless with New Tread Design

A tubeless passenger tire with a new tread and shoulder design said to be "in keeping with the free flow lines of the newer automobiles" has been placed on the market by The Goodyear Tire & Rubber Co., Akron, O. Called Custom Super-Cushion tubeless, the tire is also claimed to have improved traction, a stronger and more flexible body, and extra strength to resist flex fatigue, punctures, and blowouts. The tire is reinforced with nylon cord and has the company's Grip-Seal construction.

BLE 25 is a superlative anti-oxidant for tyres, high speed mechanicals, compounds heavily loaded with carbon black or other fillers, as it is a flux of the best type. Its heat-ageing qualities and flex-cracking resistance have no equal among anti-oxidants.

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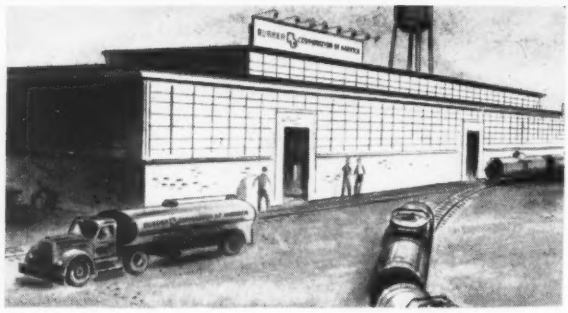

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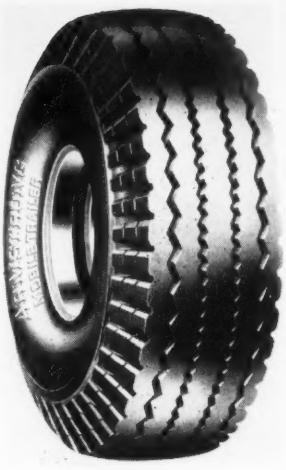
Broad, Flat Trailer Tire

A trailer tire said to feature a tread that is broader, flatter, and 15% deeper is being marketed by Armstrong Rubber Co., West Haven, Conn. Known as Mobile trailer tire, it is reported to give heavy-duty service, maximum mileage, better traction, greater recappability, and to provide uniform pressure across the entire width of the tread. Its wide angled, tapered grooves provide efficient stone ejection, Armstrong says.

The tire is available in sizes 7.00/15, 6-ply; 7.00/15, 8-ply; 7.50, 8-ply; and 7.50/15, 10-ply.



Armstrong Mobile trailer tire

Goodrich "Multi-link" Rubber Matting

A linked rubber matting that will not catch women's spike-heels has been placed on the market by The B. F. Goodrich Co. Industrial Products Division, Akron, O. Called "Multi-link," the tightly linked matting is available in red, white, gray, green, and black, in 50-foot rolls, and in widths of 24, 30, 48, and 60 inches. The matting is recommended for use in public buildings where pedestrian traffic is heavy.

Firestone Tubeless Passenger Repair Kit

A tubeless passenger-tire repair kit that contains 20 partially cured rubber plugs which are chemically vulcanized with the application of heat, when the bonding cement is added, has been placed on the market by The Firestone Tire & Rubber Co., Akron, O. In addition to the 20 rubber plugs, the kit also contains a reaming tool for cleaning the puncture hole, a plug inserter, and cement cartridges. The repaired area is as strong as the tire itself, the company says.

Rough-Coated Fabric Safety Work Gloves

A safety work glove made of fabric and coated with a vinyl-base compound in a rough finish is being offered by Surety Rubber Co., Carrollton, O. Dubbed Griptite Coated Work Glove, it is said to withstand oils, acids, and solvents; while its rough finish provides a positive grip. The glove is available with coated palm and knit wrist or fully coated with knit wrist, and in 12-inch gauntlet or safety cuff styles. Women's sizes with coated palm are furnished with knit wrist only.

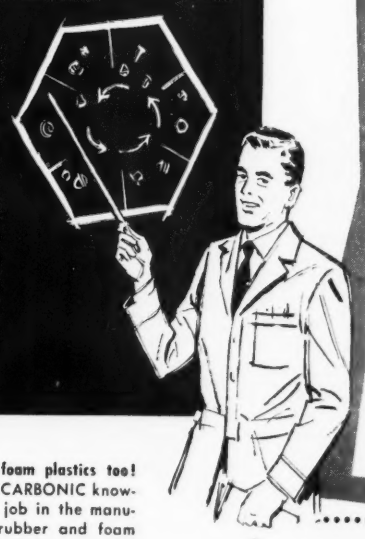
Surety Griptite Coated Work Gloves

COLD FACTS ON CO_2 TUMBLING

and how it can cut your deflashing costs in HALF

What is CO_2 tumbling and how does it work?

In CO_2 tumbling, parts to be deflashed are placed in a specially designed revolving barrel. Extremely cold (−110° F.) dry ice or liquid CO_2 is then introduced into the barrel, freezing the flashing or rind. Tumbling action of the barrel cleanly strips off the embrittled flashing, giving parts a smooth, completely flash-free finish.



Foam rubber and foam plastics too! CO_2 and LIQUID CARBONIC know-how are doing a job in the manufacture of foam rubber and foam plastics, too. We are ready to supply CO_2 at any pressure desired for use as a neutralizer or a foaming agent.

How Will CO_2 Tumbling Cut My Deflashing Costs?

By *automatically* deflashing up to 200 pounds of rubber products in one fast operation! Costly, time-consuming hand trimming is eliminated. Parts are ready for assembly or shipment in a fraction of the time required by other deflashing methods.

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Is CO_2 Tumbling Equipment Expensive?

Definitely not. Initial cost as well as operating costs of a complete CO_2 tumbling installation are amazingly low. Many manufacturers report recovery of their investment within one year.

How Can I Get More Information?

By contacting THE LIQUID CARBONIC CORPORATION, world's largest producer of CO_2 and a pioneer in CO_2 tumbling. Questions on any phase of CO_2 tumbling will receive prompt attention from qualified experts. Descriptive literature is also available. Simply mail the coupon.

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U.S. Royal Industrial Solid Tire

A solid pressed-on natural rubber industrial tire with a two-compound construction has been placed on the market by United States Rubber Co., New York, N. Y. Called U. S. Royal Industrial, the tire has its outer three-fourths made of a compound similar to that used for high-grade pneumatic truck tire tread, the company states, and the remainder is of a resilient solid-tire stock that provides a cushioning effect. Both compounds are continuous laminated build-ups, without splices. Available sizes are 8½ by 4 by 4 through 36 by 16 by 30.

Natural rubber industrial tire

Fisk Safti-Flight Eight-Ply Tubeless

What is called the world's strongest nylon passenger-car tire has been announced by Fisk tires division of U.S. Rubber. Designated Fisk Safti-Flight, the tubeless tire has an eight-ply rating, said to be twice the strength of ordinary tires, employing a new kind of nylon tire cord reputed to be twice as strong as regular nylon tire cord. Other features include cross-slitting in the tread design for improved skid resistance, extra depth in the tread design for higher mileage, and slim white sidewalls protected by a curb guard.

Republic's Cotton-Nylon Conveyor Belts

Conveyor belting with a load-carrying carcass made of plies of frictioned cotton-nylon fabric has been made available by Republic Rubber Division, Lee Rubber & Tire Corp., Youngstown, O. The fabric is woven from high-tension cotton warps and nylon fillers, according to the company, and is designed for use where regular belting of the required number of plies and weight of duck is too heavy, or where small pulleys are met. The new material is said to trough and train better and to have 25% lighter carcass weight, and less stretch. The cotton-nylon carcass is available in Republic's Type 30, Type 50, and Type 70 conveyor belts.

Firestone Super Mileage Lug Truck Tire

An all-nylon cord truck tire designed for such vehicles as dump trucks, cement mixers, logging, mining, and quarry trucks, in both on and off-the-road service, has been introduced by The Firestone Tire & Rubber Co., Akron, O. Called Super Mileage Lug, this tire, is said to have an extra-wide and cut-resistant tread with about 60% more skid depth than ordinary highway truck tires, cross grooves and heavy shoulder lugs to increase traction, and an offset shoulder design that resists sidewall cuts and snags. The tire is available in both tubeless and tubed construction.

•

Amfoil

(*Continued from page 290*)

is said to be chemically inert, to be non-adhesive and flexible, and to resist temperatures up to 200° C. The Teflon and aluminum are joined by a technique that does not require the use of any adhesive. Amfoil is available in widths up to 40 inches.

Amfoil with metal bases other than aluminum are being developed, according to the company.

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TECHNICAL BOOKS

BOOK REVIEWS

"Chemical Safety Supervision." Joseph Guelich. Reinhold Publishing Corp., New York, N. Y. Cloth, 6 by 9 inches, 226 pages. Price, $4.50.

Designed for the plant supervisor and foreman, this text discusses the many details vital to the safe operating of a chemical plant and laboratory. The forming of safety habits in workmen is especially stressed. Full chapters explain tested, proven methods of teaching the use of chemicals to new men, protecting workmen from hazards, moving and storing of chemicals, first aid, scheduling physical examinations, and other subjects. Cartoons illustrate the text.

"Economic Geography of Industrial Materials." Edited by Albert S. Carlson. Reinhold Publishing Corp., New York, N. Y. Cloth, 7 by 10 inches, 500 pages. Price, $12.50.

Written by experts in a wide range of key industries, among which are the petroleum, textile, and synthetic organic chemical industries, this comprehensive handbook describes economic-geographic conditions necessary for profitable production. Such factors as location, climate, soil, topography, water resources, minerals, fuels, labor, capital, management, transportation, and markets are discussed and evaluated to show profitable trends and conditions at present and in the future.

The book will prove invaluable to industrial managers as a means of studying a product, process, and location in the light of current and future economic conditions in a locality.

"Waste Trade Directory." 1955 Edition. Waste Trade Directory, New York, N. Y. Cloth, 6 by 9¼ inches, 1,068 pages. Price, $15.

The producers, dealers, exporters, and importers of scrap rubber and plastics are included in this directory of the waste trade industry. Equipment manufacturers and dealers are also listed.

Classification is by both state and material, and a manufacturers index is provided. The book covers the United States, Canada, and Hawaii.

NEW PUBLICATIONS

"Petrochem Lines." Vol. 1, No. 1. American Cyanamid Co., petrochemicals department, New York, N. Y. 4 pages. Among the subjects discussed in this first issue of a new series of company reports are the application of acrylonitrile in surface coatings, the reaction of acrylonitrile with halogens, and the derivation of amines from acrylonitrile.

"BRC 22 Hydrocarbon and Plaskon Polyethylene Lubricant 8417 in a Black-Filled Neoprene GN Compound." Rubber Laboratory Release No. 16. Barrett Division, Allied Chemical & Dye Corp., New York, N. Y. 12 pages. The properties and reinforcing behavior of the firm's BRC 22 Hydrocarbon and its use, together with Plaskon lubricant, in certain neoprene stocks are contained in these data sheets.

"Speed King Pilot Operated Control Valves." Bulletin SK356. Valvair Corp., Akron, O. 6 pages. Photographs, principles of operation, uses, and specifications of the company's single and double solenoid valves are presented in this folder.

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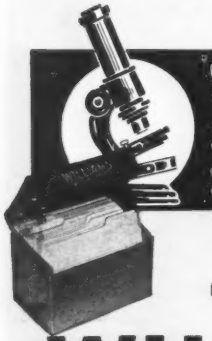

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Publications of Columbia-Southern Chemical Corp., Pittsburgh, Pa.:

"The Replacement of Natural Rubber with GR-S." Hi-Sil Bulletin No. 8-A. 2 pages. Sample recipes for replacing natural rubber with GR-S in non-black molded goods are reported here, together with postcure test data.

"Reducing Permanent Set in Non-Black Butyl Compounds." Hi-Sil Bulletin No. 9. 2 pages. Data showing the effect on Hi-Sil 233-loaded butyl stocks of Fortex, Thermoid Chemical Co.'s mixture of hydrophenanthrenic and other vegetable acids chemically treated to block unsaturation, is given in this bulletin.

"Columbia-Southern Chemicals." Vol. 1, No. 1. 24 pages. An article on the company's pigments for rubber products is included in this first issue of this illustrated quarterly magazine. Other stories describe the history of the firm and the current work of its technical service engineers, outline the uses of caustic soda in industry, and report on the continuing dominance of cotton in the fiber business.

"Hycar Latex Manual." B. F. Goodrich Chemical Co., Cleveland, O. 90 pages. This illustrated manual contains separate chapters devoted to the general properties, compounding, handling and storage, and test procedures of Hycar latices, together with discussions of the materials' applications in the textile, glass fabric, paper, leather, and adhesives industries. Included also is a discussion of the preparation of dispersions and emulsions for compounding with Hycar latices. The subjects have been indexed for ready reference.

"Hycar Latex Newsletter." Issue No. 11. 4 pages. This issue discusses the advantages of Merac, a water miscible liquid accelerator supplied by Sharples Chemical Division of Pennsylvania Salt Mfg. Co., in the manufacture of various Hycar latices. Also dealt with is the method for heat sensitizing Hycar 1571 for use as a tiecoat for adhering plastisol to rayon.

Publications of E. I. du Pont de Nemours & Co., Inc., elastomers division, Wilmington, Del.:

"Economical, Bright Colored Stocks with Blends of 'Hypalon' 20 and Rubber." B. J. McMartin, F. B. Roberts, P. V. Fullam. Report BL-309. 4 pages. The compounding of colored stocks made from equal parts of "Hypalon" 20 and natural rubber for such uses as white sidewalls, automotive parts, and coated fabrics is discussed here. A sample recipe is included.

"Antox, a Superior Antioxidant for Heat-Resistant 'Hypalon' 20 Stocks." P. V. Fullam and F. W. Keeley. Report BL-310. 2 pages. The improved heat resistance of "Hypalon" 20 stocks compounded with the company's Antox is the subject of this report. Recipes are included.

"'Hypalon' Wire and Cable." F. W. Keeley and C. E. McCormack. Report BL-311. 8 pages. A general-purpose "Hypalon" insulation compound said to have excellent electrical and physical stability on long immersion in 50 and 70° C. water is described in this publication.

"Compounding Non-Marking Neoprene Heels and Soles." R. W. Bedwell. Report BL-312. 4 pages. Sample recipes for compounding non-marking neoprene heels and soles by means of non-black reinforcing agents are contained in these data sheets, together with compounding suggestions and post-cure physical data.

"Index to Technical Reports." This is a compilation of all the technical literature published by Du Pont's elastomers division from January, 1951 through December, 1955.

"How Neoprene Compares." 2 pages. The physical properties of neoprene are compared graphically in this folder with those of natural, GR-S, nitrile and butyl type rubbers.

"HSC #362 Silicone Emulsion." Bulletin #11-118-0-2-56. Harwick Standard Chemical Co., Akron, O. 3 pages. The properties and applications of the firm's 35% base emulsion of methyl silicone fluid in water, a mold release agent for tires, mechanical rubber goods, and flooring, are included in these data sheets.

"Tergitol Surface Active Agents." Carbide & Carbon Chemicals Co., New York, N. Y. 40 pages. Physical properties, specifications, performance data, and applications of 11 of the firm's surfactants are reported in this booklet.

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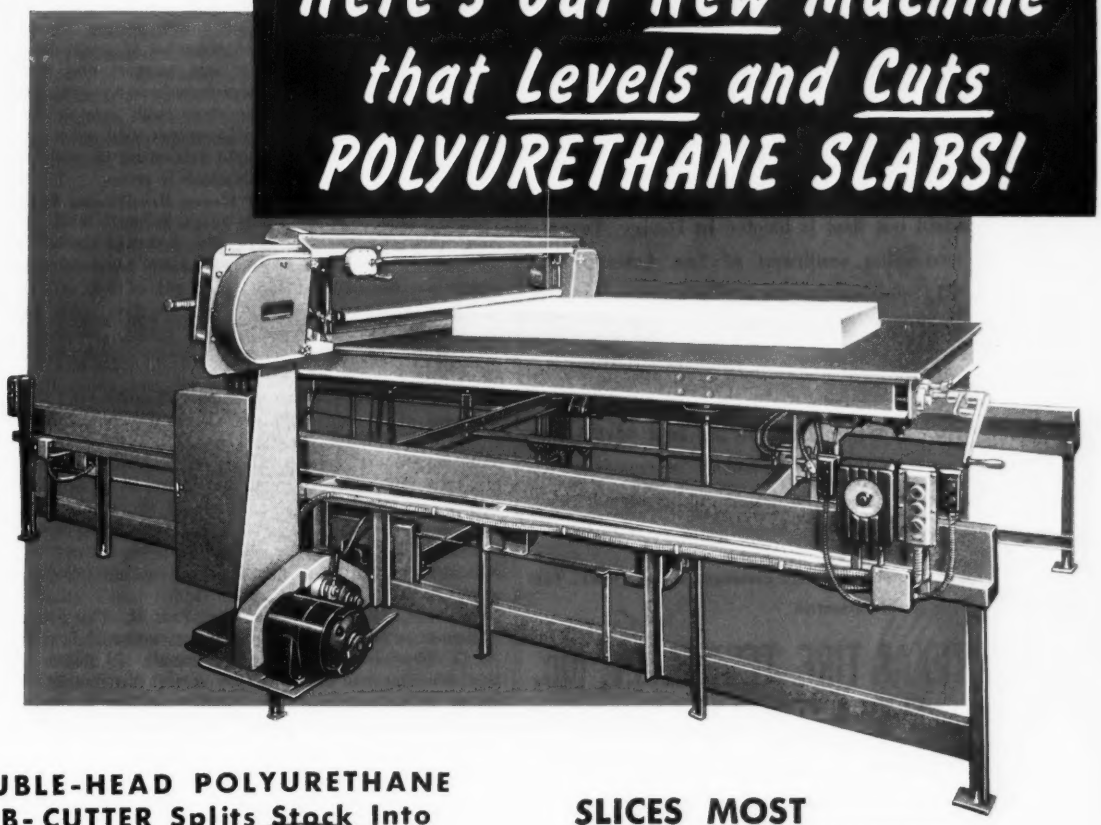

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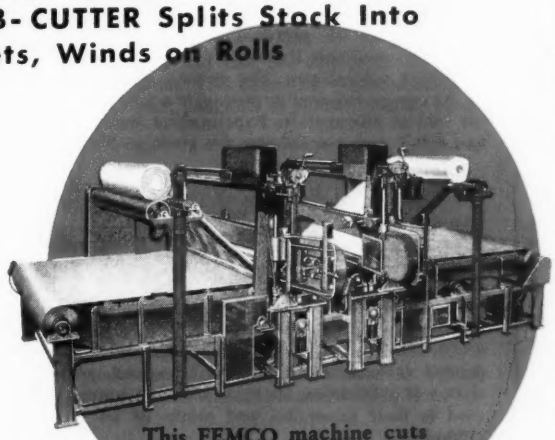

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Publications of the British Rubber Producers' Research Association, Welwyn Garden City, Herts., England:

No. 218. **"Stress Relaxation of Peroxide and Sulfur Vulcanizates of Natural Rubber."** J. P. Berry and W. F. Watson. 14 pages. Using a relaxometer of a new design, the authors investigated the stress relaxation behavior of peroxide and sulfur vulcanized natural rubber. It was learned that the peroxide vulcanizates do not degrade significantly in vacuum, but degrade by an exponential decrease in stress with time in oxygen. The vulcanizates from the two sulfur recipes used gave stress relaxation in vacuum and more rapid relaxation in oxygen. A theoretical analysis of these observations is given.

No. 219. **"The Proteins of *Hevea Brasiliensis* Latex: Part I,** Protein Constituents of Fresh Latex Serum." B. L. Archer and B. C. Sekhar. 13 pages. In this investigation seven electrophoretically distinct protein components were detected, one of which was positively charged at a pH of 8.6. After treatment with dilute ammonia solution for 15 days, only two of the original protein components were readily resolvable electrophoretically, one of which was a major component of the unammoniated serum.

No. 220. **"The Proteins of *Hevea Brasiliensis* Latex: Part II,** Isolation of the α-Globulin of Fresh Latex Serum." 6 pages. B. L. Archer and E. G. Cockbain. One of the two major protein components of fresh *Hevea* latex serum was isolated by an isoelectric precipitation method. Attempts to isolate this component by fractional precipitation of the total serum proteins with ammonium sulfate gave markedly heterogeneous products. Analytical and solubility data taken on the purified protein indicated that it is a globulin lacking non-protein prosthetic groups.

No. 222. **"Rupture of Rubber: Part II,** The Strain Concentration at an Incision; **Part III,** Determination of Tear Properties." A. G. Thomas and H. W. Greensmith. 24 pages. Part II of this investigation considers the strain distribution around the tip of an incision in a thin test piece of highly elastic material. By employing a theory previously described, relations between this strain distribution and the overall forces or strains were derived for two particular types of test pieces. The theory is here extended qualitatively to the case where the test piece is taken to the point of rupture, and experiments are described which confirm the approximate relation derived.

Part III describes a method of investigating the tear behavior of rubber vulcanizates. The method involves the determination of the energy required to propagate a tear and its dependence on the rate of propagation. Experimental results for natural rubber and GR-S gum vulcanizates are given as illustration.

Publications of the Office of Technical Services, United States Department of Commerce, Washington, D. C.:

"Some Practical Aspects of the Lot Plot Sampling Acceptance Plan." PB 111750. 39 pages. Price, $1.00. The Hamilton Lot Plot plan for statistical control is evaluated both pro and con, and possible future uses suggested.

"Random Normal Deviates." PB 111875. 122 pages. Price, $3.25. Tables of a random arrangement of 25,000 six-place normal deviates, mean zero, variance one, are included in this statistical publication, together with a description of the method used in their generation and results of tests of normality and randomness.

Publications of Celanese Corp. of America, Charlotte, N. C.:

"Fortisan-36." Technical Bulletin TD-20-A. 16 pages. The physical and chemical properties and applications of the company's highly oriented regenerated cellulose filament yarn are contained in this booklet. A table on fabric data is also included.

"Fortisan-36 in V-Belts." End-Use Bulletin No. 1. 1 page. Data on Fortisan-36 cords for V-belt applications are reported on this data sheet.

"Over 50 Years of Service through Creative Chemistry." Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn. 32 pages. This sales brochure sketches the history of the company and describes the products it manufactures, including rubber chemicals, synthetic rubbers, reclaimed rubber, natural and synthetic latices, plastics and resins, and intermediate chemicals.

"Acrylonitrile Storage and Handling." Technical Service Bulletin No. RM-20. Monsanto Chemical Co., plastics division, Springfield, Mass. 4 pages. The types of piping, pumps, valves, filters, gaskets, and other equipment for handling and storing acrylonitrile are described in this publication.

"Monsanto International." Vol. IX, No. 1. 32 pages. This special issue of this illustrated periodical is devoted to polyethylene and discusses the material's properties; applications in film, injection molding, wire and cable coatings, pipe, and bottles; and possible future developments. Copies are available in both English and Spanish.

"Industrial Fire Hose." Bulletin 3740. The B. F. Goodrich Co. Industrial Products Division, Akron, O. 4 pages. The company's industrial fire hose is described and illustrated here.

"ASTM Standards on Textile Materials." 1956 Edition. American Society for Testing Materials, Philadelphia, Pa. 788 pages. Price, $5.75. The latest ASTM tentative and standard methods of test, specifications, and definitions pertaining to textile materials are included in this volume. Of the 118 standards and tentatives, 22 are new or revised since the last edition. Thirteen appendices cover several proposed test methods and recommendations.

"1956 Tiargi Yearbook." Vol. XV. The Los Angeles Rubber Group, Inc., Los Angeles, Calif. 98 pages. This latest edition of the yearbook includes a roster of members, names and addresses of Pacific Coast rubber manufacturers and suppliers to the industry, reports of the organization's meetings during the previous year, and papers read at technical sessions. Among the latter is an article on elastomeric cellular materials by T. H. Rogers, The Goodyear Tire & Rubber Co., first published by RUBBER WORLD in its August and September, 1955, issues.

"Rubatex Vinyl Foam." Great American Industries, Inc., Rubatex Division, Bedford, Va. 24 pages. Ideas for application of the company's vinyl foam are given in this booklet.

"Color Performance Chart for Hot Die Stamping." M. Swift & Sons, Inc., Hartford, Conn. This chart lists performance data for hot die stamping of such materials as rubber, plastic, nylon, and paper.

"Effect of Linear Pressure on Rubber Covered Squeeze Rolls." Report No. 9. Rodney Hunt Machine Co., Orange, Mass. 2 pages. This bulletin discusses the degree to which high pressures commonly used in modern equipment decrease roll life.

"Fundamentals of Controlled Volume Pumping." Technical Paper No. 65. Milton Roy Co., Philadelphia, Pa. 6 pages. This is a reprint of a paper on factors governing accuracy in controlled volume pumping, delivered at the tenth annual Instrument-Automation Conference in Los Angeles, September, 1955.

"The Question of Chronological vs. Physiological Aging in Industry." Occupational Health Institute, New York, N. Y. 10 pages. This booklet discusses the meaning of "old age" in society generally and in industry specifically and advocates that men be retired from their job according to their fitness for it, not according to their age.

"Current Safety Topics in the Rubber Industry." Vol. 24. National Safety Council, Chicago, Ill. 10 pages. An article and a round-table discussion on rubber industry safety are published here as presented in sessions of the Council's Rubber Section at the forty-third National Safety Congress.

"A List of Dag Dispersions for Industry." Acheson Colloids Co., Port Huron, Mich. 4 pages. Properties, specifications, and applications of the company's 41 colloidal and semi-colloidal dispersions, many of which function as lubricants in rubber and plastics manufacturing, are listed in this revised publication.

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MARKET REVIEWS

Natural Rubber

Natural rubber prices on both the spot and future markets continued their sharp decline during the early part of the March 16-April 15 period, but a slight recovery was effected later, and a perceptible steadiness set in at period-end. In spot trading, the #1 grade of R.S.S. slid more than 3¢ a pound between March 16 and March 26, from 35.38¢ to 32.25¢. The grade recovered tentatively, fell back to 32¢ on April 3, then gained again to 33.38¢ on April 13, the last trading day in the period under consideration.

Trading on the New York Commodity Exchange was normal during the last half of March, but lapsed into a doldrum during the first half of April.

Essentially, the behavior of the market was in harmony with the laws of supply and demand: there were simply too much rubber available and too few takers. Offers on Far Eastern markets were very heavy during the first half of the March 16-April 15 period; while a snowstorm on the eastern coast of the United States, combined with lower production levels, reduced buying.

The recovery of the market was a direct result of the Near East crisis. What seemed like imminent war caused a flurry of buying in London and Singapore and a simultaneous withholding of offerings in the Far East. The sudden increased demand for rubber was in no sense panicky, but it served to halt the downward price trend and force a rally.

Observers believe that prices during the next month will tend to become higher as industrial production in the United States and elsewhere gears into greater volume and less rubber becomes available in the Far East.

Statistically, on the New York Commodity Exchange, sales for the second half of March were 29,700 tons, bringing the monthly total to 60,340 tons. Sales during the first half of April reached 19,340 tons. Sales during the March 16-April 15 period were 49,040 tons, reflecting the low volume of trading.

Near-March stocks began the period at 34.25¢ for the #1 grade and came to an end at 30.75¢ on March 27. May stocks began the period at 34.25¢ and dropped to 32.70¢ by April 13. There were 20 trading days during the period.

On the physical market, average March monthly spot prices for representative grades were as follows: R.S.S. #1, 34.44¢; R.S.S. #3, 34.13¢; #3 Amber Blankets, 31.78¢; and Flat Bark, 24.52¢. There were 21 trading days during March. For the first half of April, R.S.S. #1 averaged 32.70¢.

COMMODITY EXCHANGE
WEEK-END CLOSING PRICES

Futures	Mar. 16	Mar. 23	Mar. 29	Apr. 6	Apr. 13
Mar.	34.25	31.80	——	——	——
May	34.25	32.40	31.25	31.80	32.70
July	33.25	31.85	31.10	31.55	32.45
Sept.	32.50	31.35	30.45	30.95	31.75
Dec.	32.10	30.50	30.00	30.45	30.95
Total weekly sales, tons	14,740	11,860	15,190	10,700	8,640

NEW YORK SPOT MARKET
WEEK-END CLOSING PRICES

	Mar. 16	Mar. 23	Mar. 29	Apr. 6	Apr. 13
R.S.S.: #1	35.38	33.25	32.63	32.63	33.38
2	35.25	33.00	32.38	32.38	33.13
3	35.13	32.75	32.13	32.13	32.88
Latex Crepe #1 Thick	39.38	37.75	37.38	37.38	38.38
Thin	39.38	37.75	37.38	37.38	38.38
#3 Amber Blankets	31.75	31.75	31.00	31.13	31.63
Thin Brown Crepe	31.75	31.38	30.63	30.75	31.25
Flat Bark	25.00	23.75	23.13	23.00	23.38

Synthetic Rubber

Reports indicate an easing in demand for styrene-butadiene rubbers (SBR) during most of March and the first half of April. The cut in automotive production was the reason cited for this situation. It would also seem that the steadily falling prices of natural rubber over the past four months have prodded consumers into considering the possibility of replacing some SBR in their goods with the natural product. Should this happen to any great extent, SBR producers would have to curtail their operations to about a 75% capacity level instead of the current 110% of rated capacity, and production costs would rise. Pressures for higher prices would then build up, resulting in an even greater slackening of demand for SBR, which would increase these pressures, continuing the self-perpetuating cycle.

These are the theoretical considerations. The situation might materialize if all things were equal, but the present healthy state of the economy would seem to rule that out. For one thing, automotive production is expected to move into higher gear during May, boosting the demand for SBR.

At any rate, both producers and consumers of styrene-butadiene rubbers have welcomed the current breathing spell. The easier demand has given producers an opportunity to work on an overdue catalyst replacement in the butadiene plants and repair and maintenance in the copolymer plants.

One way of lowering synthetic rubber production costs is to reduce the number of types and grades manufactured, and it is becoming increasingly evident that producers are taking steps to achieve this. New but only slightly modified grades which are expected to be in good demand are also to be announced in the near future.

Foreign demand for American rubbers still remains unabated. In effect, this continues to act as a strong price stabilizer on the domestic market. Observers freely predict that there will be heavier synthetic rubber exports during 1957. Planned plant expansions here will raise synthetic rubber production to 1,700,000 tons by the end of 1957, and American manufacturers will not need such annual amounts until 1960, permitting surpluses to be sent abroad. In an anticipated late-April report President Eisenhower is expected to tell Congress that there should be more than ample supplies of synthetic rubber for domestic use until 1960. Future expansions will certainly provide for home requirements beyond 1960.

Latex

The continued fall in the price of *Hevea* latex during the period from March 16 to April 15 finally induced consumers to come in on the market, and the volume of buying was fairly heavy. It was apparent that consumers did not believe prices would keep on dropping much longer, and they did not want to be caught by a sudden upward trend. The market was featured by interest in forward shipment of both drum and bulk latex up to the end of the year. The demand for early shipment was relatively poor, reflecting the strength of stocks.

Stocks of synthetic latices were believed to be somewhat improved. Production was said to be high as continued demand for the fulfilling of orders forced maximum output quotas everywhere.

Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b. rail tank cars, ranged during the period from 39 to 44¢ per pound solids. Prices of synthetic latices remained the same, being quoted as GR-S type, 26-32.3¢; neoprene, 37-47¢; and N-type, 46-54¢.

Final January and preliminary February domestic statistics for all latices follow:

(All Figures in Long Tons, Dry Weight)

Type of Latex	Production	Imports	Consumption	Month-End Stocks
Natural				
Jan.	0	10,328	6,395	15,529
Feb.	0	.....	6,230	16,396
GR-S Type				
Jan.	6,770	115	5,858	6,522
Feb.	6,846	...	6,119	7,045
Neoprene				
Jan.	848	0	722	1,093
Feb.	930	0	785	1,211
Nitrile				
Jan.	919	0	519	1,339
Feb.	827	0	780	1,423

Polymel DX

may be the answer to your problem!

Many compounders are using versatile POLYMEL DX to solve a variety of problems. For example, this low-cost styrene copolymer resin is being used

- **In Extruded Goods—for easy processing, high speed operation, good lubricating action, and good retained outline in the uncured state;**
- **In High Styrene Compounds—to lower costs by reducing significantly the quantity of high styrene resin without lowering physicals;**
- **In MOLDED GOODS—for easy processing, good mold flow, excellent detail, and reduced shrinkage;**
- **In Calendered Goods—for easy processing, fine surface finish and faithful retention of embossed details;**
- **In Heel, Sole and Slab Stocks—to impart good physicals and easy processing properties to highly loaded stocks.**

If your problem is among these, you owe it to yourself to try POLYMEL DX at once. Available in powder or 2″ lump form, we will be glad to send a generous sample on request.

Prices fob Baltimore		
	1 drum to 4900 lbs.	— .1475¢ lb.
	5000 lbs. to truckloads	— .1425¢ lb.
	Truckloads	— .1375¢ lb.

THE Polymel CORPORATION

MANUFACTURERS OF

compounding ingredients for reinforcing, plasticizing, extending and processing natural and synthetic elastomers.

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Scrap Rubber

Activity on the scrap rubber market came to a sudden halt during the first half of the period from March 16 to April 15 as a snowstorm hit the eastern section of the United States and crippled movement of scrap rubber. Yards were finally cleared about the first of April, but thaws converted many storage sites into quagmires, further hampering shipments. The last week of the period, however, saw a flurry of business, with suppliers busy filling April shipments to Naugatuck and other firms.

The general consensus of opinion in the trade is that business will show considerable improvement during May and June.

December export figures were not yet available from the United States Department of Commerce.

The snowstorm forced $1-a-ton increases, at eastern points, of No. 3 peelings and tire buffing. Akron prices held.

Period-end prices follow:

	Eastern Points	Akron, O.
	(Per Net Ton)	
Mixed auto tires	$14.00/16.50	$16.50
S.A. G. auto tires	Nom.	Nom.
Truck tires	14.00	17.00
Peelings, No. 1	41.00/42.00	41.00/42.00
2	23.00	25.00
3	17.00	19.00
Tire buffing	15.00	14.00/15.00
	(¢ per Lb.)	
Auto tubes, mixed	3.50	3.50
Black	5.75	5.75
Red	6.50	6.50
Butyl	4.50	Nom.

Reclaimed Rubber

The reclaimed rubber market improved considerably during the period from March 16 to April 15, and indications are strong that the better business level will continue throughout May as automotive production picks up.

Figures released by the United States Department of Commerce show that 26,205 long tons of natural and synthetic reclaimed rubber were produced in this country during January and 25,827 long tons were consumed. Exports during the month were 1,382 long tons. Preliminary figures for February are production, 27,005 long tons; and consumption, 25,977 long tons. February export totals are not yet available.

Midwest Rubber Reclaiming Co. has reduced the price of its butyl reclaim ½¢ a pound to 15¢. Other companies are expected to follow suit. The rest of the price schedule remained the same.

RECLAIMED RUBBER PRICES

	lb.
Whole tire: first line	$0.105
Fourth line	.0925
Inner tube: black	.15
Red	.21
Butyl	.15
Pure gum, light colored	.23
Mechanical, light colored	.135

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity at special prices.

Cotton Fabrics

Slow trading prevailed in the industrial fabrics market during the period from March 16 to April 15, with most transactions confined to small, fill-in lots for quick and nearby delivery.

In wide goods, relatively little trading took place on the mill level. Trading in wide drills was largely confined to second-hand goods, with small yardages being bought for prompt shipment to meet fill-in needs of coaters. Trading also was slow in cotton ducks, with numbered, Army, and flat ducks being sold at current market levels for quick delivery as industrial users covered on their immediate requirements.

The generally slow trading pace has resulted in a moderate amount of cutbacks in production among some mills. Heaviest reductions have been noted among the fringe, or marginal, producers of wide fabrics who first began producing these goods during the upward swing of demand which developed in industrial fabrics during the last several months of the past year.

Observers predicted, however, that trading in industrial fabrics would become more active during the second quarter as auto manufacturers begin placing additional orders to meet their requirements in the months ahead.

There were no price changes during the period.

COTTON FABRICS

Drills		
59-inch 1.85 yd.	*yd.*	$0.39
2.25-yd.		.33/.335
Ducks		
38-inch 1.78-yd. S.F.	*yd.*	nom.
2.00-yd. D.F.		.34
51.5-inch, 1.35-yd. S.F.		.4963
Hose and belting		.69
Osnaburgs		
40-inch 2.11-yd.	*yd.*	.265
3.65-yd.		.1675
Raincoat Fabrics		
Printcloth, 38½-inch, 64x60, 5.35-yd.	*yd.*	.15
6.25 yd.		.1275
Sheeting, 48-inch, 4.17-yd.		.20
52-inch, 3.85-yd.		.24
Chafer Fabrics		
14.40-oz./sq. yd. Pl.	*yd.*	.70
11.65-oz./sq. yd. S.		.61
10.80-oz./sq. yd. S.		.6575
8.9-oz./sq. yd. S.		.67
Other Fabrics		
Headlining, 59-inch, 1.65-yd., 2-ply	*yd.*	.465
64-inch, 1.25-yd., 2-ply		.595
Sateens, 53-inch, 1.32-yd.		.5675
58-inch, 1.21-yd.		.62
Tire Cord		
1242 Standard	*lb.*	.83

Rayon

Total calculated production of rayon and acetate yarn during March was 71,000,000 pounds, of which 34,500,000 pounds were regular-tenacity yarn, and 36,500,000 were rayon high-tenacity yarn. February production had been: total, 68,900,000 pounds; regular-tenacity, 34,400,000 pounds; and high-tenacity, 34,500,000 pounds.

Total domestic shipments for March were 67,600,000 pounds, consisting of 30,800,000 pounds of regular-tenacity yarn and 36,800,000 pounds of rayon high-tenacity yarn. February shipments had been: total, 71,800,000 pounds; regular-tenacity, 37,100,000 pounds; and high-tenacity, 34,700,000 pounds.

Total end-of-March stocks were 49,500,000 pounds, of which 42,400,000 pounds were regular-tenacity yarn and 7,100,000 pounds were high-tenacity rayon yarn. End-of-February stocks had been: total, 46,100,000 pounds; regular-tenacity, 38,700,000 pounds; and high-tenacity, 7,400,000 pounds.

The price war between rayon and nylon tire yarn producers continues, with the rayon industry determined to maintain its dominant position, and the nylon industry equally determined to improve its status.

American Viscose Corp. announced two successive price cuts during April. As of this writing, April 19, its price schedule, per pound, is as follows: Super Rayflex, 1650 denier, type 110, 63¢; Super Rayflex, 1650 denier, type 200-300, 61¢; regular 1100 denier, 62¢; regular 1650 denier, 58¢; and regular 2200 denier, 58¢.

Latest reductions of Industrial Rayon Corp. are the following: 1650-denier Tyron 100, to 58¢; and 1650-denier Tyron 200, to 63¢.

Beaunit Mills, Inc., has slashed its super high-tenacity yarns to 64¢ and its regular high-tenacity yarns to 61¢.

RAYON PRICES

Tire Yarns	
High-Tenacity	
1100/ 480	$0.62/$0.67
1100/ 490	.62/ .67
1150/ 490	.67
1165/ 480	.68
1230/ 490	.67
1650/ 720	.58/ .64
1650/ 980	.58/ .64
1875/ 980	.64
2200/ 960	.58/ .63
2200/ 980	.58/ .63
2200/1466	.67
4400/2934	.63
Super-High-Tenacity	
1650/ 720	.63/ .69
1900/ 720	.69
Tire Fabrics	
1100/490/2	.77
1650/980/2	.725
2200/980/2	.715

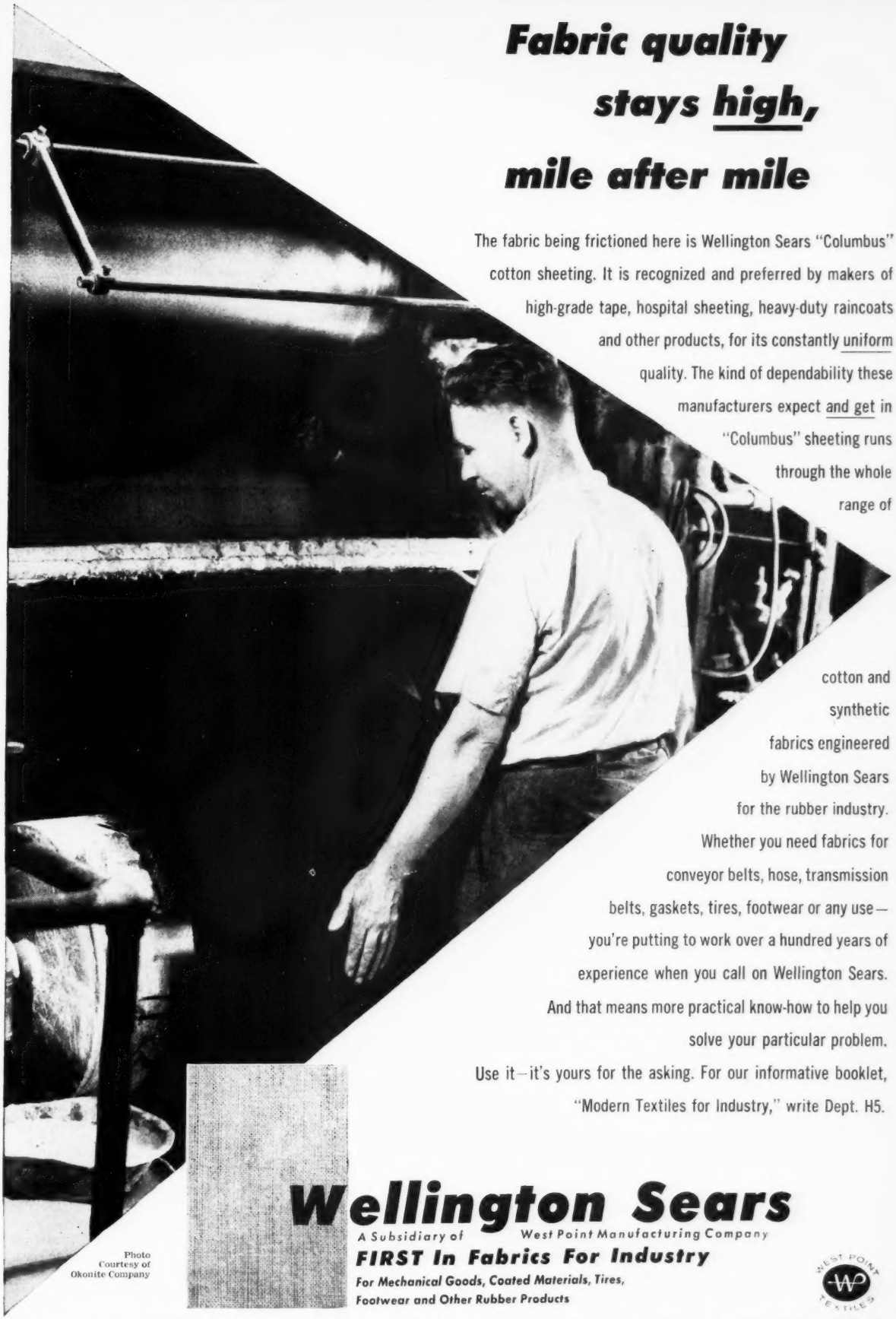
•

French Building Butyl Unit

Esso Research & Engineering Co., New York, N. Y., has licensed a French firm to build the first butyl synthetic rubber plant outside of North America. The firm is Societe du Caoutchouc Butyl, a corporation formed by 10 French companies.

To be built at Port Jerome, near Le Havre, France, the plant will have an annual capacity of 20,000 tons and is expected to be completed in 1958. It is anticipated that the production will meet projected French requirements of the rubber, as well as allow some for export.

(*Continued on page 314*)



Fabric quality stays high, mile after mile

The fabric being frictioned here is Wellington Sears "Columbus" cotton sheeting. It is recognized and preferred by makers of high-grade tape, hospital sheeting, heavy-duty raincoats and other products, for its constantly uniform quality. The kind of dependability these manufacturers expect and get in "Columbus" sheeting runs through the whole range of cotton and synthetic fabrics engineered by Wellington Sears for the rubber industry.

Whether you need fabrics for conveyor belts, hose, transmission belts, gaskets, tires, footwear or any use—you're putting to work over a hundred years of experience when you call on Wellington Sears. And that means more practical know-how to help you solve your particular problem.

Use it—it's yours for the asking. For our informative booklet, "Modern Textiles for Industry," write Dept. H5.

Photo Courtesy of Okonite Company

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For Mechanical Goods, Coated Materials, Tires, Footwear and Other Rubber Products

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Synthetic Rubbers and Latices*

Acrylic Types

Hycar 4021	$1.35[c]
4501	.81[c]

Isobutylene Types

Enjay Butyl 035, 150, 215, 217, 218, 325	.23[a]
165, 265, 267, 268, 365	.24[a]
Hycar 2202	.65[c]
Polysar Butyl 100, 200, 300, 400	.245[c]
101	.2775[a]
301	.255[c]
Vistanex	.45[a]

Neoprene

Neoprene Type AC, CG	.55[a]
GN, GN-A	.41[a]
GRT, S	.42[a]
KNR	.75[a]
W	.39[a]
WRT	.45[a]

Latices

Neoprene Latex 571, 842-A	.37[a]
572	.39[a]
601-A	.40[a]
735, 736	.38[a]
950	.47[a]

Nitrile Types

Butaprene NAA	.54[a]
NF	.49[a]
NL	.50[a]
NXM	.58[a]
Chemigum N1NS	.64[b]
N3NS, N5	.58[b]
N6, N7	.50[b]
Hycar 1001, 1041	.58[c]
1002, 1042, 1042	.50[c]
1014, 1312	.60[c]
1411	.62[c]
1432	.59[c]
1441	.64[c]
Paracril AJ	.485[a]
B, BJ, BLT	.50[a]
C	.58[a]
D	.65[a]
1880	.60[a]
Polysar Krynac 800, 802, 803	.50[c]
801	.58[c]

Latices

Butaprene N-300	.46[b]
N-400, N-401	.54[b]

[a] Freight extra.
[b] Minimum freight allowed.
[c] Freight prepaid.
*Prices are per pound carload or tank-car dry weight unless otherwise specified.
†Listed below are the new GR-S type synthetic rubbers and latices trade names and the chief sales offices of their producers or distributors.

ASRC —American Synthetic Rubber Corp., 500 Fifth Ave., New York 36, N. Y.
Baytown —United Rubber & Chemical Co., Baytown, Tex. (producer); United Carbon Co., Inc., Charleston 27, W. Va. (distributor).
Butaprene —Firestone Tire & Rubber Co., Synthetic Rubber Division, 381 Wilbeth Rd., Akron 1, O.
Copo —Copolymer Rubber & Chemical Corp., P. O. Box 1029, Baton Rouge 1, La.
G-G —Goodrich-Gulf Chemicals, Inc., 3121 Euclid Ave., Cleveland 15, O.
Naugapol, Naugatex —Naugatuck Chemical Division, United States Rubber Co., Naugatuck, Conn.
Philprene —Phillips Chemical Co., Rubber Chemicals Division, 318 Water St., Akron 8, O.
Plioflex —Goodyear Tire & Rubber Co., Chemical Division, Akron 16, O.
Pliolite Latex—Goodyear Tire & Rubber Co., Chemical Division. Also distributed by General Latex & Chemical Corp., 666 Main St., Cambridge 39, Mass.
Polysar —Polymer Corp., Ltd., Sarnia, Ont., Canada (producer); H. Muehlstein & Co., Inc., 60 E. 42nd St., New York 17, N. Y. (distributor).
S- —Shell Chemical Corp., Synthetic Rubber Sales Division, 30 W. 50th St., New York 20, N. Y.
Synpol —Texas-U. S. Chemical Co., Port Neches, Tex. (producer); Naugatuck Chemical (distributor).
‡SBR —Styrene butadiene rubber.
§BR —Butadiene rubber.

Chemigum 200	$0.49[b]
235 CHS, 236	.54[b]
245 B, 245 CHS, 246	.46[b]
Hycar 1512, 1552, 1562, 1577	.46[c]
1551, 1561	.54[c]
1571	.59[c]
1572	.51[c]
Nitrex 2612, 2614	.46[a]
2615	.51[a]

Polysulfide Types

Thiokol LP-2, -3, -32, -33	.96[a]
-8, -38	1.25[a]
PR-1	.95[a]
Type-A	.47[a]
FA	.69[a]
ST	1.00[a]

Latices

Thiokol Latex (dry wt.)	
Type MF	.85[a]
MX	.70[a]
WD-2	.92[a]
-5	.95[a]
-6, -7	.70[a]

Silicone Types

GE (compounded)	$2.25[a] / $4.10[a]
Silicone gum (not compounded)	4.00[a] / 4.90[a]
Silastic (compounded)	1.95[b] / 4.50[b]

Styrene Types†

Hot SBR‡

Butaprene S 1000, 1001, 1004, 1006	.23[a]
1009, 1013	.26[a]
1010	.265[a]
1012	.27[a]
1015	.28[a]
G-G 1001, 1006	.241[c]
Naugapol 1016, 1019	.265[b]
1018	.27[b]
1021	.30[b]
1022	.28[b]
1023	.285[b]
Philprene 1000, 1001, 1006	.25[b]
1009	.255[b]
1018	.27[b]
1019	.265[b]
Plioflex 1000, 1006	.2425[c]
Polysar S, S-50, S-65	.241[c]
SS-250	.30[c]
S-X-371	.255[c]
S-1000, -1001, -1006, -1013	.23[a]
-1002, -1011	.2325[a]
Synpol 1000, 1001, 1006, 1007, 1012, 1061	.2425[b]
1002	.245[b]
1009	.2475[b]
1013	.25[b]

Hot SBR Black Masterbatch

S-1100	.185[a]

Cold SBR

ASRC-1500, -1502	.241[c]
Butaprene S 1500, 1502	.23[a]
Copo 1500, 1502	.241[c]
G-G 1500, 1501, 1502	.241[c]
Naugapol 1503	.27[b]
1504	.295[b]
Philprene 1500, 1502	.25[b]
1503	.27[b]
Plioflex 1502	.2425[c]
Polysar Krylene	.241[c]
S-1500, -1502	.23[b]
Synpol 1500, 1551	.2425[b]

Cold SBR Black Masterbatch

Baytown 1600, 1601, 1602	.185[a]
Philprene 1601	.198[b]
1605	.194[b]
S-1600, -1601, -1602	.185[a]

Cold SBR Oil Masterbatch

Butaprene S 1703	.195[a]
1705	.1925[a]
1710	.1775[a]
G-G 1703	.206[c]
1705, 1706	.2035[c]
1707	.191[c]
1709, 1710, 1711, 1712	.1885[c]
Philprene 1703	$0.212[b]
1706	.21[b]
1708	.197[b]
1712	.194[b]
Plioflex 1703	.2075[c]
1710	.19[c]
Polysar Krynol	.20[c]
S-1703	.195[a]
-1705, -1706	.1925[a]
-1707	.18[a]
-1709, -1712	.1775[a]
Synpol 1703	.2075[b]
1707	.1925[b]
1708	.195[b]
1711	.19[b]

Cold SBR Oil-Black Masterbatch

Baytown 1801	.17[a]
Philprene 1803	.179[b]
S-1801	.17[a]

Hot SBR Latices

Butaprene S Latex Type 2000, 2001, 2006	.26[a]
2002	.285[a]
2003, 2004	.295[a]
Naugatex 2000, 2001, 2006	.263[a]
2002	.288[a]
2005	.30[a]
S-2000	.2275[a]

Hot BR Latex§

S-2004	.26[a]

Cold SBR Latices

Butaprene S Latex Type 2105	.31[a]
Copo 2101	.28[c]
2102, 2105	.31[c]
X-765	.29[c]
Naugatex 2101	.285[a]
2105	.312[a]
X-767	.323[a]
Pliolite Latex 2101, X765	.30[c]
2105	.32[c]
S-2101	.225[a]

Cold BR Latex

Pliolite Latex 2104	.32[c]

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French Butyl

(*Continued from page 312*)

Currently there are only three butyl plants in the world. These are Polymer Corp.'s unit at Sarnia, Ont., Canada; Esso Standard Oil Co.'s plant at Baton Rouge, La.; and Humble Oil & Refining Co.'s unit at Baytown, Tex. The total capacity of these is about 115,000 tons annually.

Two other United States companies have been licensed by Esso Research to build butyl plants here.

Esso has also licensed Societe du Caoutchouc Butyl to use its technique for recovering isobutylene, the principal ingredient of butyl rubber, from refinery gases.

Caprolan Nylon Prices Cut

National Aniline Division, Allied Chemical & Dye Corp., New York, N. Y., has reduced the prices of its Caprolan high-tenacity nylon heavy yarns.

The new price schedule, per pound, follows: 2100 denier, $1.27; 2500 denier, $1.27; 3360 denier, $1.26; 5000 denier, $1.25; 7500 denier, $1.24; 10,000 denier, $1.24; and 15,000 denier, $1.23.

A Specialty Elastomer with Extra-Special Properties

HYPALON® 20

OZONE–

No HYPALON product has ever been known to fail due to ozone attack. (See Reports 55-3, 55-5, BL-269.)

HEAT–

HYPALON products perform well at high temperatures. (See Reports 55-3, BL-262, BL-267, BL-306, BL-310.)

CORROSIVE CHEMICALS–

Exceptional resistance to acids and other strong oxidizing chemicals. (See Reports BL-258, BL-261, BL-267.)

SUNLIGHT–

Weatherability of HYPALON products is excellent. Brilliant colors stay bright. (See Reports BL-251, BL-274, BL-297, 55-5.)

Physical properties and processing are good . . .

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BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

Compounding Ingredients*

Abrasives

Pumicestone, powdered	lb.	$0.0363/	$0.065
Rottenstone, domestic	lb.	.03 /	.04
Shelblast	ton	80.00 /	165.00
Walnut Shell Grits	ton	50.00 /	160.00

Accelerators

A-1 (Thiocarbanilide)	ton	.50 /	.57
A-32	ton	.66 /	.80
A-100	lb.	.52 /	.66
Accelerator 49	lb.	.55 /	.56
108	lb.	.90	
552	lb.	2.25	
808	lb.	.66 /	.68
833	lb.	1.17 /	1.19
Altax	lb.	.50 /	.52
Arazate	lb.	2.25	
Beutene	lb.	.66 /	.71
Bismate	lb.	3.00	
B-J-F	lb.	.27 /	.32
Butasan	lb.	1.04	
Butazate	lb.	1.04	
Butyl Accelerator 21	lb.	.89	
Eight	lb.	1.10 /	1.35
Zimate	lb.	1.04	
Captax	lb.	.40 /	.42
C-P-B	lb.	1.95	
Cumate	lb.	1.45	
Diesterex N	lb.	.50 /	.57
DOTG (diorthotolylguanidine)			
Cyanamid	lb.	.60 /	.61
Du Pont	lb.	.57 /	.58
DPG (diphenylguanidine)			
Cyanamid	lb.	.50 /	.51
Monsanto	lb.	.48 /	.55
El-Sixty	lb.	.58 /	.65
Ethasan	lb.	1.04	
Ethazate	lb.	1.04	
50-D	lb.	.85	
Ethyl Thiurad	lb.	1.04	
Tuads	lb.	1.04	
Tuex	lb.	1.04	
Zimate	lb.	1.04	
Ethylac	lb.	.93 /	.95
Hepteen	lb.	.44 /	.50
Base	lb.	1.85	
Ledate	lb.	1.04	
MBT (2-mercaptobenzothiazole)			
American Cyanamid	lb.	.40 /	.42
Du Pont	lb.	.38 /	.40
Naugatuck	lb.	.40 /	.45
-XXX, Cyanamid	lb.	.51 /	.53
MBTS (mercaptobenzothiazyl disulfide)			
Cyanamid	lb.	.50 /	.52
Du Pont	lb.	.48 /	.50
Naugatuck	lb.	.50 /	.55
-W Cyanamid	lb.	.53 /	.55
Merac	lb.	.75 /	1.05
Mertax	lb.	.51 /	.58
Methasan	lb.	1.04	
Methazate	lb.	1.04	
Methyl Tuads	lb.	1.14	
Zimate	lb.	1.04	
Monex	lb.	1.14	
Mono-Thiurad	lb.	1.14	
Morfex	lb.	.65 /	.70
MT	lb.	1.00	
NOBS No. 1	lb.	.72 /	.74
Special	lb.	.77 /	.79
O-X-A-F	lb.	.51 /	.56
Pentex	lb.	1.04	
Flour	lb.	.21	
Permalux	lb.	2.17	
Phenex	lb.	.52 /	.59
Pip-Pip		2.07	
R-2 Crystals	lb.	4.35	
Rotax	lb.	.51 /	.53
RZ-50, -50B	lb.	1.00	
S. A. 52	lb.	1.14	
57, 62, 67, 77	lb.	1.04	
66	lb.	2.50	
Santocure	lb.	.72 /	.79
NS	lb.	.78 /	.85
Selenacs	lb.	4.25	
Sharples 52-1, 52-3, 52-9	lb.	1.14	
62-0, 62-9, 57-1, 57-3, 57-9, 67-1, 77-0	lb.	1.04	
66-1	lb.	4.25	
SPDX-GH	lb.	.69 /	.74
GL	lb.	1.20 /	1.34
Tellurac	lb.	1.21	
Tepidone	lb.	.45	
Tetrone A	lb.	1.91	
Thiofide	lb.	.50 /	.57
S	lb.	.52 /	.59
Thionex	lb.	1.14	
Thiotax	lb.	.40 /	.47
Thiurad	lb.	1.14	
Thiuram E	lb.	1.04	
M	lb.	1.14	
Trimene	lb.	.56 /	.62
Base	lb.	1.03 /	1.10
Tuex	lb.	1.14	
Ultex	lb.	$1.00 /	$1.10
Unads	lb.	1.14	
Ureka Base	lb.	.66 /	.73
Vulcacure NB	lb.	.45	
ZB, ZE, ZM	lb.	.85	
Vulcacure Z-B-X	lb.	2.45	
Zenite	lb.	.48 /	0.50
A	lb.	.49 /	.51
Special	lb.	.49 /	.51
Zetax	lb.	.51 /	.53
Zimate	lb.	1.04	

Accelerator-Activators, Inorganic

Lime, hydrated	ton	20.21	
Litharge, comml.	lb.	.175 /	.18
Eagle, sublimed	lb.	.18	
National Lead, sublimed	lb.	.18 /	.19
Red lead, comml.	lb.	.185 /	.195
Eagle	lb.	.19	
National Lead	lb.	.19 /	.20
White lead, carbonate	lb.	.19 /	.20
Eagle	lb.	.19 /	.20
National Lead	lb.	.18 /	.19
Silicate	lb.	.1725/	.1825
Eagle	lb.	.20 /	.2175
National Lead	lb.	.1625/	.1725
Zinc oxide, comml.†	lb.	.145/	.1925

Accelerator-Activators, Organic

Aktone	lb.	.2125/	.2325
Barak	lb.	.62	
Capital 170	lb.	.2175/	.2575
171	lb.	.1325/	.1725
700, 701	lb.	.16 /	.20
705, 710	lb.	.16 /	.20
800	lb.	.12/	.14
801	lb.	.1425/	.1625
802	lb.	.1475/	.1675
803	lb.	.17 /	.19
Curade	lb.	.57 /	.59
D-B-A	lb.	1.95	
Emery 600	lb.	.1375/	.1775
Groco 30	lb.	.1375/	.1775
35	lb.	.1425/	.1825
Guantal	lb.	.57 /	.64
Hyfac 400	lb.	.1188/	.145
430	lb.	.1613/	.1875
431	lb.	.1838/	.1975
Hystrene S-97	lb.	.1863/	.2125
T-45	lb.	.1638/	.19
T-70	lb.	.1738/	.20
Industrene B	lb.	.1263/	.1525
R	lb.	.1138/	.14
158	lb.	.1313/	.1575
254	lb.	.1413/	.1675
262	lb.	.1513/	.1775
Laurex	lb.	.33 /	.37
MODX	lb.	.295 /	.345
NA-22	lb.	1.50	
Oleic acid, comml.	lb.	.185 /	.225
Emersol 210 Elaine	lb.	.165 /	.205
Groco 2, 4, 8, 18	lb.	.165 /	.205
Plastone	lb.	.27 /	.30
Polyvac	lb.	1.65	
Ridacto	lb.	.25 /	.26
Seedine	lb.	.1485/	.1703
Stearex Beads	lb.	.1488/	.1588
Stearic acid			
Emersol 120	lb.	.1463/	.1725
150	lb.	.1738/	.20
Hydrofol 51	lb.	.09	
Hydrogenated, rubber grd.			
Groco	lb.	.125 /	.145
Rufat 75	lb.	.1188/	.145
Single pressed, comml.	lb.	.1475/	.1675
Emersol 110	lb.	.1413/	.1675
Groco 53	lb.	.1475/	.1675
Wilmar 253	lb.	.1413/	.1675
Double pressed, comml.	lb.	.1525/	.1725
Groco 54	lb.	.1525/	.1725
Wilmar 254	lb.	.1463/	.1725
Triple pressed, comml.	lb.	.175 /	.195
Groco 55	lb.	.175 /	.195
Wilmar 255	lb.	.1688/	.195
Sterene 60-R	lb.	.09 /	.1075
Tonox	lb.	.515 /	.605
Vulklor	lb.	.88 /	1.08
Wilmar 110	lb.	.165 /	.205
434	lb.	.1375/	.1775
Zinc stearate, comml.	lb.	.39 /	.44

Antioxidants

AgeBest A26	lb.	.18 /	.24
620-32B	lb.	.20 /	.26
716-30	lb.	.18 /	.24
1041-21	lb.	.165 /	.225
1293-22A	lb.	1.90 /	2.00
AgeRite Alba	lb.	2.35 /	2.45
Gel	lb.	.64 /	.66
H. P.	lb.	.72 /	.74
Hipar	lb.	.98 /	1.00
Powder	lb.	.52 /	.54
Resin	lb.	.75 /	.77
D	lb.	.52 /	.54
Spar	lb.	.52 /	.54
Stalite	lb.	.52 /	.54
S	lb.	.52 /	.54
White	lb.	1.45 /	1.55
Akroflex C	lb.	.77 /	.79
CD	lb.	.72 /	.74
Albasan	lb.	.69 /	.73
Allied AA-1144	lb.	$0.23 /	$0.24
AA-1177	lb.	.155 /	.165
Aminox	lb.	.52 /	.57
Antioxidant 425	lb.	2.47 /	2.50
2246	lb.	1.50 /	1.53
Antisol	lb.	.23 /	.24
Antisun	lb.	.15 /	.51
Antox	lb.	.52 /	.75
Aranox	lb.	3.25 /	.54
Betanox Special	lb.	.80 /	.85
B-L-E, -25	lb.	.52 /	.57
Burgess Antisun Wax	lb.	.185	
B-X-A	lb.	.52 /	.57
Copper Inhibiter X-872-L	lb.	2.01	
D-B-P-C	lb.	.91 /	1.16
Flectol H	lb.	.52 /	.59
Flexamine	lb.	.72 /	.77
Heliozone	lb.	.26 /	.27
Ionol	lb.	.91 /	1.40
NBC	lb.	1.55	
Neozone A	lb.	.56 /	.58
D	lb.	.52 /	.54
Octamine	lb.	.52 /	.57
PDA-10	lb.	.46 /	.48
Perflectol	lb.	.61 /	.68
Polygard	lb.	.52 /	.57
Protector	lb.	.26 /	.31
Rio Resin	lb.	.60 /	.62
Santoflex 35	lb.	.72 /	.79
75	lb.	.92 /	.99
AW	lb.	.78 /	.85
B	lb.	.52 /	.59
BX	lb.	.63 /	.70
DD	lb.	.52 /	.59
Santovar A	lb.	1.50 /	1.57
Santowhite Crystals, Powder	lb.	1.60 /	1.67
L	lb.	.52 /	.59
MK	lb.	1.29 /	1.36
Sharples Wax	lb.	.23 /	.28
Stabilite	lb.	.55 /	.59
Alba	lb.	.72 /	.79
L	lb.	.60 /	.64
White	lb.	.52 /	.60
Powder	lb.	.41 /	.47
Styphen I	lb.	.51 /	.55
Sunolite #100	lb.	.21 /	.25
#127	lb.	.17 /	.19
Sunproof -713	lb.	.25 /	.30
Improved	lb.	.25 /	.30
Jr.	lb.	.20 /	.25
Thermoflex A	lb.	.98 /	1.00
Tonox	lb.	.52 /	.57
Tysonite	lb.	.24 /	.2475
Velvapex 51-250	lb.	.40	
V-G-B	lb.	.70 /	.70
Wing-Stay S	lb.	.52 /	.61
Zenite	lb.	.48 /	.55

Antiseptics

Copper naphthenate, 6–8%	lb.	.24	
Pentachlorophenol	lb.	.21 /	.29
Resorcinol, technical	lb.	.775 /	.785
Zinc naphthenate, 8-10%	lb.	.245 /	.30

Blowing Agents

Ammonium bicarbonate	lb.	.065 /	.085
Carbonate	lb.	.16	
Blowing Agent CP-975	lb.	.35	
Celogen	lb.	1.95	
50-C	lb.	1.01 /	1.07
Sodium bicarbonate	100 lbs.	2.80 /	3.15
Carbonate, tech.	100 lbs.	1.35 /	5.52
Sponge Paste	lb.	.20	
Unicel	lb.	.90	
ND	lb.	.76	
S	lb.	.20	

Bonding Agents

Braze	gal.	6.00 /	9.00
Cover cement	gal.	2.50 /	4.00
Flocking Adhesive RFA17, RFA22, RFA25	lb.	.50	
G-E Silicone Paste SS-15	lb.	4.52 /	5.10
SS-64	lb.	3.65 /	6.75
-67 Primer	lb.	7.50 /	12.50
Gen-Tac Latex	lb.	.70 /	.805
Kalabond Adhesive	gal.	6.50 /	16.00
Tie Cement	gal.	2.00 /	5.60
Hylene M	gal.	3.50 /	3.75
M-50	gal.	1.90 /	2.15
Thixons	gal.	1.48 /	12.00
Ty Ply BN, Q, S, UP, 3640	gal.	6.75 /	8.00
RC	gal.	3.75 /	5.00

Brake Lining Saturants

BRT 3	lb.	.018 /	.0265
Resinex L-S	lb.	.0225/	.03

Carbon Blacks‡

Conductive Channel—CC

Continental R-40	lb.	.23 /	.30
Kosmos/Dixie BB	lb.	.23 /	.30
Spheron C	lb.	.15 /	.195
Voltex	lb.	.18 /	.315

Easy Processing Channel—EPC

Continental AA	lb.	.074 /	.1225
Kosmobile 77/Dixiedensed 77	lb.	.074 /	.1225
Micronex W-6	lb.	.074 /	.1225
Spheron #9	lb.	.074 /	.1225
Texas E	lb.	.074 /	.1225
Witco #12	lb.	.074 /	.1225
Wyex EPC	lb.	.074 /	.1225

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.

‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.

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Inspector Mike and Moe Muscles have known for years that Dow Corning silicone mold lubricants are by all odds the most efficient *and economical* rubber release agents available. Yet, every now and then they have to prove these advantages. But they're glad of the chance because it's a sure bet.

Experience has taught them that the initial cost of a mold lubricant becomes relatively unimportant when you consider production rates, maintenance, quality, and scrap. Mountains of evidence prove Dow Corning silicone mold lubricants give fast and easy release . . . cut mold maintenance as much as 80% . . . reduce rejects to the vanishing point . . . produce more finished parts with the sharpest detail and finest surface finish. What more could anyone ask?

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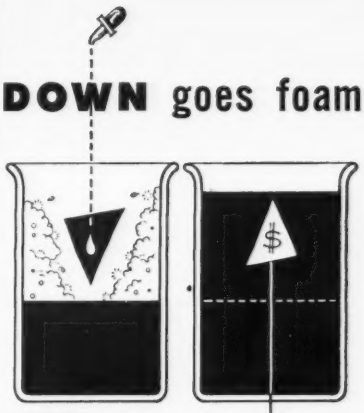
DOWN goes foam



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- **3,125 lb** butadiene styrene emulsion
- **1,250 lb** neoprene latex

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Hard Processing Channel—HPC

Continental F	lb.	$0.074 /	$0.1225
HX HPC	lb.	.074 /	.1225
Kosmobile S/Dixiedensed S	lb.	.074 /	.1225
Micromex Mk. II	lb.	.074 /	.1225
Witco #6	lb.	.074 /	.1225

Medium Processing Channel—MPC

Arrow MPC	lb.	.074 /	.1225
Continental A	lb.	.074 /	.1225
Kosmobile S-66/Dixiedensed S-66	lb.	.074 /	.1225
Micronex Standard	lb.	.074 /	.1225
Spheron #6	lb.	.074 /	.1225
Texas 109	lb.	.079 /	.1275
M	lb.	.074 /	.1225
Witco #1	lb.	.074 /	.1225

Conductive Furnace—CF

Aromex CF	lb.	.089 /	.129
Vulcan C	lb.	.105 /	.15
SC	lb.	.18 /	.223

Fast Extruding Furnace—FEF

Arovel FEF	lb.	.06 /	.10
Continex FEF	lb.	.06 /	.10
Kosmos 50/Dixie 50	lb.	.06 /	.10
Statex M	lb.	.06 /	.10
Sterling SO	lb.	.06 /	.10

Fine Furnace—FF

Statex B	lb.	.065 /	.105
Sterling 99	lb.	.065 /	.105

High Abrasion Furnace—HAF

Aromex HAF	lb.	.074 /	.114
Continex HAF	lb.	.079 /	.125
Kosmos 60/Dixie 60	lb.	.079 /	.1175
Philblack O	lb.	.074 /	.114
Statex R	lb.	.074 /	.12
Vulcan #3	lb.	.074 /	.114

Intermediate Super Abrasion Furnace—ISAF

Aromex ISAF	lb.	.09 /	.13
Kosmos 70/Dixie 70	lb.	.10 /	.145
Philblack I	lb.	.09 /	.13
Statex 125	lb.	.09 /	.135
Vulcan 6	lb.	.09 /	.13

Medium Abrasion Furnace—MAF

Philblack A	lb.	.06 /	.10

Super Abrasion Furnace—SAF

Philblack E	lb.	.125 /	.165
Vulcan 9	lb.	.125 /	.165

General-Purpose Furnace—GPF

Arogen GPF	lb.	.05 /	.09
Sterling V	lb.	.05 /	.09
V Non-staining	lb.	.05 /	.09

High Modulus Furnace—HMF

Continex HMF	lb.	.055 /	.095
Kosmos 40/Dixie 40	lb.	.055 /	.095
Modulex HMF	lb.	.055 /	.095
Statex 93	lb.	.055 /	.095
930	lb.	.047 /	.087
Sterling L, LL	lb.	.055 /	.095

Semi-Reinforcing Furnace—SRF

Continex SRF	lb.	.045 /	.085
Essex SRF	lb.	.0475/	.0875
Furnex	lb.	.0475/	.0875
Gastex	lb.	.0525/	.0925
Kosmos 20/Dixie 20	lb.	.045 /	.085
Pelletex, NS	lb.	.0475/	.0875
Sterling NS, S	lb.	.0475/	.0875
R	lb.	.0525/	.0925

Fine Thermal—FT

P-33	lb.	.0575	
Sterling FT	lb.	.055	

Medium Thermal—MT

Sterling MT	lb.	.04	
Non-staining	lb.	.05	
Thermax	lb.	.04	
Stainless	lb.	.05	

Colors

Black

Iron oxides, comml.	lb.	.1325/	.135
BK—Lansco	lb.	.1275/	.13
Williams	lb.	.145	
Lansco synthetic	lb.	.10	
Mapico	lb.	.1425/	.145
Lampblack, comml.	lb.	.16 /	.45
Superjet	lb.	.0825/	.1175
Permanent Blue	lb.	.80 /	1.05
Stan-Tone	lb.	.45 /	1.20
Vansul masterbatch	lb.	.60 /	.65
Paste	lb.	.14 /	.15

Blue

Alkali Blue	lb.	1.12 /	2.10
Cyanamid ultramarine	lb.	.29	
Du Pont	lb.	1.77 /	4.55
Filo	lb.	.28	
Heveatex pastes	lb.	.80 /	1.45
Lansco ultramarines	lb.	.25 /	.28
Monsanto Blue 7	lb.	1.55	
11	lb.	3.45	
DPB-283	lb.	1.93	
S-11	lb.	2.05	
Permanent Blue	lb.	$0.80 /	$1.05
Stan-Tone	lb.	1.55 /	1.60
Vansul masterbatch	lb.	.90 /	2.70

Brown

Filo	lb.	.13	
Iron oxides, comml.	lb.	.1425/	.145
Lansco synthetic	lb.	.125	
Mapico Brown	lb.	.1525/	.155
Sienna, burnt, comml.	lb.	.0425/	.155
Williams	lb.	.115 /	.1775
Raw, comml.	lb.	.045 /	.1325
Williams	lb.	.08 /	.1725
Umber, burnt, comml.	lb.	.06 /	.07
Williams	lb.	.0725/	.085
Raw, comml.	lb.	.0625/	.07
Williams	lb.	.07 /	.0825
Williams, pure brown	lb.	.155	
Vandyke	lb.	.12	
Mapico Tan 20	lb.	.2025/	.205
Tan 15	lb.	.205	
Metallic Brown	lb.	.05 /	.06
Vansul masterbatch	lb.	2.10 /	2.20

Green

Chrome	lb.	.19 /	.50
Oxide	lb.	.3925/	1.10
Cyanamid	lb.	1.10	
G-4099, -6099	lb.	.425	
GH-9869	lb.	1.05 /	1.20
9976	lb.	1.15 /	1.30
Green	lb.	.80 /	2.40
Du Pont	lb.	1.97 /	2.80
Filo	lb.	.40	
Heveatex pastes	lb.	.95 /	1.85
Lansco Toner	lb.	1.35	
Monsanto Green 3	lb.	2.75	
14	lb.	1.45	
17	lb.	3.95	
71205	lb.	1.35	
DGP	lb.	2.03	
S-17	lb.	2.25	
Stan-Tone	lb.	1.75 /	4.60
Vansul masterbatch	lb.	2.00 /	2.60

Orange

Cyanamid Permatons	lb.	1.35	
Du Pont	lb.	2.75	
Monsanto Orange 68187	lb.	2.90	
Stan-Tone	lb.	.70 /	5.05
Vansul masterbatch	lb.	2.00 /	2.60

Red

Antimony trisulfide	lb.	.285 /	.315
R. M. P. No. 3	lb.	.72	
Sulfur Free	lb.	.78	
Brilliant Toning Red	lb.	1.95	
Cadmium red lithopones	lb.	2.21 /	3.77
Cadmolith	lb.	1.72 /	2.20
Cyanamid	lb.	.85 /	1.60
Du Pont	lb.	1.47 /	1.80
Filo	lb.	.11	
Indian Red	lb.	.1275	
Iron oxide, comml.	lb.	.06 /	.13
Lansco synthetic	lb.	.1175	
Mapico	lb.	.1375/	.14
Recco	lb.	.12	
Williams Red	lb.	.13 /	.1525
Monsanto Maroon 113	lb.	1.50	
61148	lb.	1.75	
Red 7	lb.	1.55	
41	lb.	4.40	
3501	lb.	1.15	
4004	lb.	1.50	
69191	lb.	3.38	
Autumn	lb.	1.10	
PRP-285	lb.	1.27	
S-44	lb.	1.28	
Rub-Er-Red	lb.	.0975	
Stan-Tone	lb.	.85 /	6.15
Tuscan	lb.	.15 /	.46
Vansul masterbatch	lb.	.95 /	3.30
Venetian	lb.	.04 /	.0675

White

Antimony oxide	lb.	.27 /	.285
Burgess Iceberg	ton	50.00 /	80.00
Cryptone BT	lb.	.10 /	.11
Permolith	lb.	.075 /	.085
Titanium pigments			
Rayox LW	lb.	.195 /	.205
R-110	lb.	.215 /	.225
Ti-Cal	lb.	.075 /	.0825
Ti-Pure	lb.	.195 /	.225
Titanox A, AA, A-168	lb.	.21 /	.22
C-50	lb.	.1225/	.1275
RA, -10, -50	lb.	.23 /	.24
RC	lb.	.0825/	.0875
-HT, -HTX	lb.	.08 /	.085
Unitane	lb.	.245 /	.275
Zopaque Anatase	lb.	.225 /	.235
Rutile	lb.	.245 /	.255
Zinc oxide, comml.	lb.	.145 /	.1825
Azo ZZZ-11, -44, -55	lb.	.145 /	.165
20% leaded	lb.	.1505/	.1705
35% leaded	lb.	.155 /	.175
50% leaded	lb.	.1588/	.1788
Eagle AAA, lead free	lb.	.145 /	.155
5% leaded	lb.	.145 /	.155
35% leaded	lb.	.155 /	.165
50% leaded	lb.	.159 /	.169
Florence Green Seal	lb.	.1575/	.1675
Red Seal	lb.	.1525/	.1625
White Seal	lb.	.1625/	.1725
Horsehead XX-4, -78	lb.	.135 /	.145
Kadox-15, -17, -72, -515	lb.	.14 /	.15
25	lb.	.1625/	.1725
Lehigh, 35% leaded	lb.	.155 /	.175
50% leaded	lb.	.1586/	.1788
Protox-166, -167	lb.	$0.145 /	$0.165
St. Joe, lead free	lb.	.122 /	.152
Zinc sulfide, comml.	lb.	.253 /	.263
Cryptone ZS	lb.	.253 /	.273

Yellow

Cadmium yellow lithopones	lb.	1.12 /	1.15
Cadmolith	lb.	1.12 /	1.20
Cyanamid Hansa Yellow	lb.	2.10	
Du Pont	lb.	1.80 /	2.15
Filo	lb.	.10	
Iron oxide, comml.	lb.	.0525/	.1175
Lansco synthetic	lb.	.1075	
Mapico	lb.	.115 /	.1225
Williams	lb.	.115 /	.1225
Monsanto Yellow 14	lb	1.91	
10010	lb.	1.91	
BYP-282	lb.	1.21	
GA	lb.	2.45	
S-10010	lb.	1.17	
Stan-Tone	lb.	1.00 /	1.55
Vansul masterbatch	lb.	.95 /	1.95
Williams Ocher	lb.	.0575/	.06

Dusting Agents

Diatomaceous silica	ton	32.00 /	48.00
Extrud-o-Lube, conc	gal.	1.54 /	1.69
Glycerized Liquid Lubricant, concentrated	gal.	1.48 /	1.63
Latex-Lube GR	lb.	.20	
Pigmented	lb.	.1825	
R-66	lb.	.165	
Liqui-Lube	lb.	.1625	
N. T.	lb.	.1675	
Liquizinc No. 305	lb.	.30 /	.35
Lubrex	lb.	.25 /	.30
Mica Concord	lb.	.075 /	.0825
Mineralite	ton	45.00	
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Talc, comml.	ton	18.40 /	38.50
EM	ton	11.00 /	63.00
LS Silver	ton	29.25	
Nytals	ton	25.00 /	36.00
Sierra Sagger 7	ton	34.00	
White IR	ton	19.75	
III	ton	20.75	
Vanfre	gal.	2.00 /	

Extenders

BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
Cumar Resins	lb.	.065 /	.17
Dielex B	lb.	.06	
Factice, Amberex	lb.	.29 /	.36
Brown	lb.	.1425/	.268
Neophax	lb.	.157 /	.268
White	lb.	.144 /	.285
G. B. Asphaltenes	lb.	.06 /	.065
Millex, W	lb.	.07	
Mineral Rubbers			
Black Diamond	ton	38.00 /	40.00
Hard Hydrocarbon	ton	46.50 /	48.50
Hydrocarbon MR	ton	45.00 /	55.00
Parmr	ton	21.00 /	29.00
T-MR Granulated	ton	47.50 /	50.00
Nuba No. 1, 2	lb.	.0575/	.0625
3X	lb.	.0775/	.0825
OPD-101	lb.	.26	
Rubber substitute, brown	lb.	.1835/	.2012
Car-Bel-Ex A	lb.	.14	
Car-Bel-Lite	lb.	.35	
Extender 600	lb.	.1765	
White	lb.	.148 /	.256
Stan-Shells	ton	35.00 /	73.00
Sublac Resin PX-5	lb.	.215 /	.235
Synthetic 100	lb.	.41	
Vistanex	lb.	.35 /	.475

Fillers, Inert

Agrashell flour	ton	50.00 /	74.00
Barytes, floated, white	ton	41.60 /	60.10
Off-color, domestic	ton	25.00	
No. 1	ton	41.35 /	60.10
2	ton	39.35 /	58.00
Sparmite	ton	75.00 /	80.00
Blanc fixe	ton	100.00 /	165.00
Burgess Iceberg	ton	50.00 /	80.00
Pigment #20	ton	35.00 /	60.00
#30	ton	37.00 /	60.00
HC-75	ton	12.00 /	30.00
-80	ton	14.00 /	32.00
WP #1	ton	11.00 /	16.00
Cary #200	ton	30.00 /	55.00
Citrus seed meal	lb.	.04	
Oil	lb.	.15	
Clays, Aiken	ton	14.00	
Albacar	ton	50.00 /	55.00
Aluminum Flake	ton	20.00 /	60.00
#5	ton	23.50 /	30.00
Champion	ton	14.00	
Crown	ton	14.00 /	33.00
Dixie	ton	14.00	
Franklin	ton	13.50 /	35.25
GK Soft Clay	ton	11.00	
Hi-White R	ton	13.50	
Hydratex R	ton	28.00	
Kaolloid	ton	10.50	
Paragon	ton	13.50 /	31.50
McNamee	ton	13.50	
RX-43	ton	33.00	
Recco	ton	14.00	
Sno-Brite	ton	12.50	
Stan-Clay	ton	28.00	
Stellar-R	ton	50.00	
Suprex	ton	14.00 /	32.00
Swanee	ton	12.50	
Windsor	ton	14.00 /	30.00

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Lead & Zinc Compounds

meet the specific demands of the rubber industry . . .

Eagle-Picher manufactures a comprehensive line of both lead and zinc compounds for the rubber industry. Rigid product control is maintained from the ore to the finished product. More than a century of experience assures you of customer service unequalled in the field.

Zinc Oxides	Litharge
Basic White Lead Silicate	Sublimed Litharge
Basic Carbonate of White Lead	Red Lead (95% 97% 98%)
Sublimed White Lead	Sublimed Blue Lead

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Since 1843

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On the Pacific Coast: ASSOCIATED LEAD AND ZINC COMPANY
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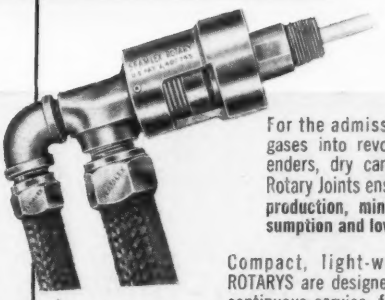
use SEAMLEX ROTARY the Rotary Joint for Steam, Water, Oil, Air, etc.



For the admission of liquids or gases into revolving drums, calenders, dry cans, etc., SEAMLEX Rotary Joints ensure **uninterrupted production, minimum power consumption and lowest maintenance.**

Compact, light-weight SEAMLEX ROTARYS are designed to render long, continuous service, free from leakage.

Seamlex Rotarys are provided with Seamlex Quality Hose.

External Screw Adjustment provides means to compensate for normal wear, without removal of joint from equipment. Floating Graphite Seal prevents excessive wear. Pressure Equalizing Chamber reduces power consumption.

SEAMLEX COMPANY, INC.

Take advantage of SEAMLEX Company's many years of experience in design and manufacturing. Write today for FREE Bulletins 955 & 5500A.

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LONG ISLAND CITY 1, N. Y.

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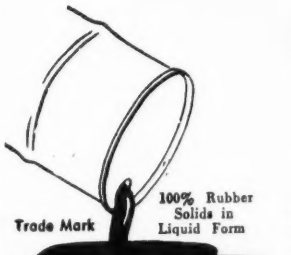
Depolymerized Rubber



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SOUTHEASTERN CLAY CO.

AIKEN, SOUTH CAROLINA

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The C. P. HALL CO. of Calif.	Los Angeles
WYROUGH & LOSER	Trenton, N. J.
THE PIGMENT & CHEMICAL CO., LTD.	Toronto

DC Silica	lb.	$1.45 /	$1.65
Diatomaceous silica	ton	42.00 /	48.00
Flocks			
Cotton, dark	lb.	.095 /	.135
Dyed	lb.	.55 /	.60
White	lb.	.13 /	.33
Fabrifil X-24-G	lb.	.135	
X-24-W	lb.	.235	
Filfloc 6000	lb.	.33	
F-40-900	lb.	.135	
HSC #35 Silicone Emulsion	lb.	1.28 /	2.50
Kalite	ton	50.00 /	65.00
Lithopone, comml.	lb.	.075 /	.085
Albalith	lb.	.075 /	.085
Astrolith	lb.	.063¾/	.0675
Eagle	lb.	.0725/	.075
Sunolith	lb.	.075 /	.0825
Mica Concord	lb.	.075 /	.0825
Millical	ton	38.00 /	53.00
Mineralite	ton	40.00 /	60.00
Non-Fer-Al	ton	32.50 /	47.50
Purecal	ton	56.75 /	71.75
Pyrax A	ton	13.50	
W. A.	ton	16.00	
Sawdust	ton	14.00 /	35.00
Silversheen Mica	lb.	.08 /	.09
StanWhite	ton	10.50 /	13.10
Super-White Silica	ton	23.00 /	43.00
Surfex	ton	37.50 /	52.50
MM	ton	39.50 /	54.50
Suspenso	ton	35.50 /	50.50
Ti-Cal	lb.	.0675	
Valron estersil	lb.	1.00	
Walnut shell flours	ton	40.00 /	80.00
Whiting, limestone			
Atomite	ton	30.00	
Calcite	ton	23.00	
Keystone	ton	16.00	
Laminar	ton	30.00	
Omya	ton	30.00	
Paxinosa	ton	11.00 /	19.00
Snowflake	ton	17.00 /	18.00
Stonelite	ton	9.00	
Witco	ton	8.50	
York	ton	9.50	

Finishes

Apex Bright Finish #5200-E	lb.	.25	
Rubber Finish	gal.	2.50	
Black-out	gal.	4.50 /	8.00
Flocks, Rayon, colored	lb.	.90 /	1.50
White	lb.	.75 /	1.25
Also see Flocks, under Fillers, Inert			
Rubber lacquer, clear	gal.	1.00 /	2.00
Shellacs, Angelo	lb.	.485 /	.7325
Vac Dry	lb.	.485 /	.57
Talc (*See Talc, under Dusting Agents*)			
Unidip	lb.	.15 /	.20
Wax, Bees	lb.	.68 /	.83
Carnauba	lb.	.57 /	1.13
Montan	lb.	.27	
No. 118, colors	gal.	.86 /	1.41
Neutral	gal.	.76 /	1.31
Van Wax	gal.	1.45 /	1.50

Latex Compounding Ingredients

Acintol D, DLR	lb.	.06 /	.075
FA #1	lb.	.065 /	.08
#2	lb.	.075 /	.09
Accelerator 552	lb.	2.25	
J-117, -302	lb.	1.00 /	1.15
-144	lb.	.15 /	.30
-307	lb.	1.10 /	1.25
-311	lb.	.60 /	.75
Aerosol, dry types	lb.	.39 /	1.20
Liquid types	lb.	.40 /	.72
Alcogum AN-6	lb.	.05	
AN-10	lb.	.085	
Alrosol	lb.	.41	
Alrowet D-75	lb.	.63	
Amberex solutions	lb.	.1675/	.18
Antifoam J-114	lb.	3.25 /	3.45
P-242	lb.	.24 /	.35
Antioxidant J-137, -140	lb.	.55 /	.70
-139, -293	lb.	1.45 /	1.60
-182	lb.	2.00 /	2.15
-186	lb.	1.40 /	1.55
2246	lb.	1.50 /	1.53
Anti Webbing Agent J-183	lb.	.75 /	.90
-297	lb.	.27 /	.40
Aquablak B	lb.	.0925/	.0975
G	lb.	.105 /	.11
K	lb.	.1075/	.1125
M	lb.	.085 /	.09
Aquarex D	lb.	.78	
G	lb.	.21	
L, ME	lb.	.94	
MDL	lb.	.33	
NS	lb.	.60	
SMO	lb.	.50	
WAQ	lb.	.23	
Areskap 50	lb.	.30 /	.38
100, dry	lb.	.60 /	.72
Aresket 240	lb.	.30 /	.38
300, dry	lb.	.60 /	.72
Aresklene 375	lb.	.42 /	.57
Ben-A-Gels	lb.	.98 /	1.40
Bentone 18, 18C	lb.	.45	
34	lb.	.60	
Casein	lb.	.22	
Cellosize WP-09, -3, -300	lb.	1.36 /	1.60
CW-12	lb.	.85	
37	lb.	.70	
DC Antifoam A Compound	lb.	5.45 /	6.65
Emulsion	lb.	2.05 /	4.00
AF Emulsion	lb.	2.05 /	2.85
Compound 7	lb.	5.13 /	6.50
Defoma W-1701	lb.	$0.125	
Detoamer 115a	lb.	.50	
Dispersing Agents			
Blancol	lb.	.1525/	$0.26
N	lb.	.155 /	.26
Darvan Nos. 1, 2, 3	lb.	.22 /	.30
Daxad 11, 21, 23, 27	lb.	.08 /	.30
Dispersaid H7A	lb.	.58	
1159	lb.	.43	
Empulphor ON-870	lb.	.50 /	.70
Igepal CO-630	lb.	.2875/	.47
Igepon T-73	lb.	.285 /	.495
T-77	lb.	.45 /	.69
Indulins	lb.	.06 /	.08
Kreelons	lb.	.132 /	.155
Laurelton Oil	lb.	.18	
Leonil SA	lb.	.52 /	.65
Lomar PW	lb.	.18	
Marasperse CB	lb.	.1225/	.1425
N	lb.	.095 /	.105
Modicols	lb.	.17 /	.58
Nekal BA-75	lb.	.395 /	.54
BX-76	lb.	.63 /	.75
Pluronics	lb.	.335 /	.40
Polyfons	lb.	.08 /	.09
Sorapon SF-78	lb.	.28 /	.40
Tergitol NPX	lb.	.275 /	.3074
TMN	lb.	.2875/	.32
7	lb.	.4125/	.44
Trenamine	lb.	.15	
Triton R-100	lb.	.12 /	.25
X-100, -102, -114	lb.	.255 /	.36
Dispersions			
AgeRite Alba	lb.	3.00	
Powder, Resin D	lb.	.80	
White	lb.	1.80	
Altax	lb.	.75	
Black No. 25	lb.	.22	
Shield Nos. 2, 6	lb.	.08	
3	lb.	.095	
4-35	lb.	.09	
5	lb.	.093	
7-F, 8	lb.	.165	
55	lb.	.18	
Iron Oxide, 60%	lb.	.40	
L.S.W.	lb.	1.50	
No. 305 Liquizinc	lb.	.30 /	.35
P-33	lb.	.35	
Rayox	lb.	.45	
Rotax	lb.	.75	
Sulfur	lb.	.12 /	.30
No. 2	lb.	.14 /	.16
Telloy	lb.	3.00	
Tuads, Methyl	lb.	1.60	
Vulcanizing, C group	lb.	.40 /	1.30
G group	lb.	.45 /	.90
N group	lb.	.40 /	1.00
Zetax	lb.	.75	
Zimates, Butyl	lb.	1.30	
Ethyl, Methyl	lb.	1.35	
Zinc oxide	lb.	.40	
Emulsions			
AgeRite Stalite	lb.	.75	
Habuco Resin Nos. 502, 515, 523	lb.	.195 /	.20
503	lb.	.22 /	.225
504, 526	lb.	.19 /	.195
517	lb.	.175 /	.18
524	lb.	.155 /	.16
Resin A-2	lb.	.16 /	.25
P-370	lb.	.175 /	.25
X-210	lb.	.12 /	.22
Freeze-Stabilizer 322	lb.	.40	
12116C	lb.	.52	
Gelling Agent P-397	lb.	.34 /	
Igepon T-43	lb.	.145 /	.35
T-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Indulins	lb.	.06 /	.08
Ludox	lb.	.1675/	.195
Marmix	lb.	.41 /	.48
Merac	lb.	.75 /	1.05
Micronex, colloidal	lb.	.06 /	.072
Monsanto Blue 4685 WD	lb.	1.60	
Green 4884 WD	lb.	1.80	
Red 127	lb.	1.25	
OPD-101	lb.	.16 /	.26
Pliolite Latex 150, 190	lb.	.32 /	.41
170	lb.	.37 /	.46
Polyvinyl methyl ether	lb.	.25 /	.45
Resin V	lb.	.13	
Roelgel 100C	lb.	.46	
Santomerse D	lb.	.44 /	.65
S	lb.	.13 /	.25
Sellogen Gel	lb.	.1275	
Sequestrene AA	lb.	.905 /	.975
30A	lb.	.245 /	.265
ST	lb.	.585 /	.615
Setsit #5	lb.	.75 /	1.05
Stablex A	lb.	.80 /	1.10
B, G	lb.	.50 /	.95
K	lb.	.27 /	.35
P	lb.	.35 /	.50
T	lb.	.14 /	.22
Surfactol 13	lb.	.345 /	.36
Webnix	lb.	1.50 /	2.50

Mold Lubricants

Acintol D	lb.	.06 /	.075
A-C Polyethylene	lb.	.30 /	.37
Akro Gel	lb.	.165	
Alipal CO-433	lb.	.25 /	.45
CO-436	lb.	.22 /	.41
Aquarex Compounds	lb.	.21 /	.94
Carbowax 200, 300, 400	lb.	.22 /	.25
1500	lb.	.255 /	.2825
4000	lb.	.31 /	.32
6000	lb.	.35 /	.36
Castorwax	lb.	.21 /	.27
Colite Concentrate	gal.	$0.90 /	$1.15
D-Tak Dip #10	gal.	4.50	
DC Mold Release Fluid	lb.	3.14 /	4.75
Compound 4, 7	lb.	5.13 /	6.50
Emulsion 7	lb.	1.59 /	2.07
8, 35, 35A, 35B, 36	lb.	1.26 /	1.80
200 Fluid	lb.	3.14 /	4.75
ELA	lb.	.82	
FT Wax 200	lb.	.265 /	.42
300	lb.	.295 /	.45
Glycerized Liquid Lubricant, concentrated	gal.	1.48 /	1.63
Igepals	lb.	.2875/	.74
Igepon AP-78	lb	.44 /	.68
T-43	lb.	.145 /	.35
-51	lb.	.125 /	.285
-73	lb.	.285 /	.495
Lubrex	lb.	.25 /	.30
Lubri-Flo	gal.	10.00 /	12.05
Lustermold	lb.	.41	
Mold Paste	lb.	.25	
Monopole Oil	lb.	.16	
Monten Wax	lb.	.57	
Para Lube	lb.	.046 /	.048
Plaskon 8406, 8407	lb.	.30 /	.37
8416, 8417	lb.	.35 /	.42
8429	lb.	.40 /	.47
Pluronics	lb.	.335 /	.44
Polyglycol E series	lb.	.29 /	.42
Rubber-Glo	gal.	.94 /	.97
SM-33, -55, -61	lb.	1.26 /	1.80
Soap, Hawkeye	lb.	1.35 /	1.45
Purity	lb.	.155 /	.165
Sodium stearate	lb.	.40	
Stoner's 700 series	gal.	1.20 /	1.25
800 series	gal.	1.26 /	1.70
900 series	gal.	1.55 /	2.55
A Series	gal.	1.80 /	4.50
Ucon 50-HB Series	lb.	.25 /	.375
Ulco	lb.	.12 /	.23
Vanfre	gal.	2.50 /	3.00

Odorants

Alamasks	lb.	.75 /	6.50
Coumarin	lb.	2.95 /	3.55
Curodex 19	lb.	4.75 /	5.05
188	lb.	5.75	
198	lb.	6.75	
Ethavan	lb.	6.75 /	7.35
Latex Perfume #7	lb.	4.00	
Neutroleum Gamma	lb.	3.60	
Rubber Perfume #10	lb.	2.60	
Vanillin, Monsanto	lb.	3.00 /	3.15

Plasticizers and Softeners

Acintol R	lb.	.065 /	.07
Adipol 2EH, 10A	lb.	.425 /	.455
BCA	lb.	.45 /	.475
ODY	lb.	.47 /	.50
Admex 710	lb.	.325	
711	lb.	.345	
744	lb.	.40	
Aro Lene #1980	lb.	.10 /	.12
Baker AA Oil	lb.	.195 /	.24
Crystal O Oil	lb.	.21 /	.255
Processed oils	lb.	.215 /	.235
Bardol, 639	lb.	.215 /	.235
B	lb.	.0625/	.065
Benzoflex 2-45	lb.	.26 /	.29
9-88	lb.	.27 /	.30
Bondogen	lb.	.55 /	.60
BRC 20	lb.	.15 /	.175
22	lb.	.025 /	.0275
30	lb.	.0125/	.021
521	lb.	.019 /	.02
BRH 2	lb.	.0213/	.0351
BRS 700	lb.	.02 /	.0285
BRT 7	lb.	.03 /	.031
BRV	lb.	.0475/	.0565
Bunarex Liquid	lb.	.0425/	.0555
Resins	lb.	.065 /	.1225
Bunnatol G, S	lb.	.40 /	.505
Butac	lb.	.125 /	.135
Butyl stearate, comml.	lb.	.255	
Binney & Smith	lb.	.23 /	.26
Hardesty	lb.	.23 /	.26
Ohio-Apex	lb.	.22 /	.25
BxDC	lb.	.40 /	.41
Cabflex HS-10	lb.	.44 /	.47
Califlux 510, 550	lb.	.025 /	.0325
G. P.	lb.	.0125/	.02
R-100	lb.	.045 /	.0525
T T	lb.	.017 /	.0245
Capryl alcohol, comml.	lb.	.195 /	.235
Binney & Smith	lb.	.18 /	.28
Hardesty	lb.	.18 /	.28
Chlorowax 40	lb.	.1625/	.1825
70	lb.	.185 /	.245
-S	lb.	.21 /	.27
Contogums	lb.	.0875/	.111
Cumar Resins	lb.	.065 /	.17
DBM (dibutyl-m-cresol) Darex	lb.	.32 /	.3475
DBP (dibutyl phthalate), comml.	lb.	.30 /	.33
Darex	lb.	.30 /	.33
Hatco	lb.	.30 /	.33
Monsanto	lb.	.30 /	.33
Naugatuck	lb.	.30 /	.33
Ohio-Apex	lb.	.30 /	.33
PX-104	lb.	.30 /	.33
Rubber Corp. of America	lb.	.30 /	.44
Sherwin-Williams	lb.	.30 /	.33
DBS (dibutylsebacate), comml.	lb.	.66 /	.69
Hatco	lb.	.66 /	.685
Monoplex	lb.	.66 /	.675
Naugatuck	lb.	.665 /	.69
PX-404	lb.	.665 /	.69

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Address All Replies to New York Office at 386 Fourth Avenue, New York 16, N. Y.

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RUBBER CHEMISTS OR CHEMICAL ENGINEERS

A large firm engaged in the manufacture of elastomers needs a number of chemists and chemical engineers holding AB or MS degrees who are interested in technical sales service and development. Two to three years experience in the rubber industry is very desirable but not essential.

If you want this type of work, you will find this a real opportunity. (Our employees know of this advertisement.)

ADDRESS BOX NO. 1899
c/o RUBBER WORLD

WANTED

MANUFACTURER'S AGENT for line of Neoprene and Hypalon protective coatings. Eastern seaboard and midwestern states. Address Box 1917, care of RUBBER WORLD.

CHEMICAL SUPPLIER TO RUBBER AND LATEX INDUSTRIES overseas requires technical salesman. Compounding experience necessary. Overseas traveling required periodically. Excellent future prospects for right man. Office located in New York City. Address Box No. 1918, care of RUBBER WORLD.

RUBBER CHEMIST OR COMPOUNDER

Preferably with Rubber Flooring and Slab-Sole Stock experience. Knowledge of Vinyl Compounding and Processing would be desirable. Must be willing to relocate. Give complete biography, references, and salary requirements. Address Box No. 1919, care of RUBBER WORLD.

RUBBER CHEMIST WANTED FOR MEDIUM-SIZE PLANT IN Ohio. Good academic background plus practical viewpoint from at least 10 years' experience. Position requires versatility, with latex dipping experience preferred and molded goods experience desirable. Very good future prospects in growing concern of excellent reputation with fine laboratory facilities. Our personnel know of this ad. Address Box No. 1920, care of RUBBER WORLD.

VINYL CHEMIST

Experience in Plastisol compounding is required. Product development and vinyl foam experience desirable, but not essential. A good opportunity for the right man. Salary commensurate with ability. Contact: PERSONNEL MANAGER, THE SUN RUBBER COMPANY, BARBERTON, OHIO.

SYNTHETIC RUBBER SALES

We require a chemist or chemical engineer with at least 3 to 5 years' rubber compounding experience, for sales work. This is an excellent opportunity for a man with the right experience and personality to get in on the ground floor with one of the major producers of synthetic rubber. Send letter of application, résumé, and recent photo, if available. All replies will be kept in strict confidence. Address Box No. 1921, care of RUBBER WORLD.

PRODUCT SALES ENGINEER—LARGE RUBBER MANUFACturer, Great Lakes area, has excellent permanent position for young man with experience in technical rubber belt design, sales development and product application work. Engineering background preferred. Excellent employee benefits. Salary open. Send complete résumé to Box No. 1922, care of RUBBER WORLD.

SITUATIONS OPEN (Continued)

WANTED

TOP-LEVEL TIRE MANUFACTURING SUPERINTENDENT:

Large Midwest plant has excellent opportunity for man whose training and experience qualify him as Tire Manufacturing Superintendent. Applications confidential. State age, experience, other pertinent information. Suggest recent photograph.

REPLY BOX No. 1900, c/o RUBBER WORLD

PLASTICS AND RUBBER PRODUCT EVALUATION

In our major expansion program we need a man experienced in rubber compounding and plastic polymer evaluation to head up a group in our laboratory.

This is an unusual opportunity to associate with a company that is expanding in the fastest growing segment of the chemical industry. Direct inquiries to:

Robert Shattuck, President
MARBON CHEMICAL DIVISION
Borg-Warner Corporation
Gary, Indiana

UNUSUAL OPPORTUNITY

WELL-ESTABLISHED EASTERN FIRM HAS OPENING FOR A CHEMIST

For development work and to assist in production.

The man we desire must be experienced in his own field.

Give complete résumé in first letter and salary expected. All replies will be held in strict confidence.

Address Box No. 1916, c/o RUBBER WORLD

DCP (dicaprylphthalate), comml.	lb.	$0.295	$0.325
Hatco	lb.	.295	.325
Monoplex	lb.	.30	.315
DDA (didecyladipate)			
Cabflex	lb.	.425	$0.455
Good-rite GP-236	lb.	.425	.57
DDP (didecylphthalate)			
Cabflex	lb.	.305	.335
Good-rite GP-266	lb.	.305	.455
Hatco	lb.	.305	.435
Defoamer X-3	lb.	.355	
DIBA (diisobutyladipate)			
Cabflex	lb.	.4325	.4625
Darex	lb.	.4325	.4625
Ohio-Apex	lb.	.4325	.4625
DIDA (diisodecyladipate)			
Monsanto	lb.	.425	.455
DIDP (diisodecylphthalate)			
Darex	lb.	.32	.35
Monsanto	lb.	.305	.335
Ohio-Apex	lb.	.305	.335
PX-120	lb.	.305	.335
Dielex B	lb.	.06	
Diethylene glycol, comml.	lb.	.1525	.1825
Wyandotte	lb.	.15	.165
Dinopol IDO	lb.	.305	.335
DIOA (diisooctyladipate)			
Cabflex	lb.	.425	.455
Naugatuck	lb.	.435	.465
PX 208	lb.	.425	.455
Rubber Corp. of America	lb.	.425	.56
DIOP (diisooctylphthalate), comml.	lb.	.305	.335
Cabflex	lb.	.305	.335
Darex	lb.	.32	.35
Hatco	lb.	.305	.335
Monsanto	lb.	.305	.335
Naugatuck	lb.	.305	.335
Ohio-Apex	lb.	.305	.335
PX-108	lb.	.305	.335
Rubber Corp. of America	lb.	.305	.45
Sherwin-Williams	lb.	.32	.34
DIOS (diisooctylsebacate), comml.	lb.	.61	.64
Rubber Corp. of America	lb.	.61	.84
DIOZ (diisooctylazelate)			
Cabflex	lb.	.48	.51
Dipolymer Oil	gal.	.33	.38
Dispersing Oil No. 10	lb.	.06	0625
DNODP (di-n-octyl-n-decyl phthalate), Monsanto	lb.	.345	375
DOA (dioctyladipate), comml.	lb.	.425	.455
Cabflex	lb.	.425	.455
Good-rite GP-233	lb.	.425	.57
Hatco	lb.	.435	.465
Monsanto	lb.	.425	.455
Naugatuck	lb.	.435	.465
PX-238	lb.	.425	.455
Rubber Corp. of America	lb.	.425	.56
DOP (dioctylphthalate), comml.	lb.	.305	.335
Cabflex	lb.	.305	.335
Darex	lb.	.32	.35
Good-rite GP-261	lb.	.305	.455
Hatco	lb.	.305	.335
Monsanto	lb.	.305	.335
Naugatuck	lb.	.305	.335
Ohio-Apex	lb.	.305	.335
PX-138	lb.	.305	.335
Rubber Corp. of America	lb.	.305	.45
Sherwin-Williams	lb.	.32	.34
DOS (dioctylsebacate), comml.	lb.	.61	.64
Hatco	lb.	.61	.635
Monoplex	lb.	.61	.635
Naugatuck	lb.	.615	.64
PX-438	lb.	.615	.64
Rubber Corp. of America	lb.	.61	.84
Drapex 3.2	lb.	.40	.45
Dutch Boy NL-A10 (DBP)	lb.	.30	.33
-A20 (DOP), A30 (DIOP)	lb.	.305	.335
-A54	lb.	.295	.325
-C20 (DOS)	lb.	.61	.63
-F21	lb.	.395	.425
-F31	lb.	.44	.47
-F41	lb.	.48	.51
Dutrex 6	lb.	.025	035
Emulphor EL-719	lb.	.52	.73
Ethox	lb.	43	.455
Ethylene glycol, comml.	lb.	.135	.165
Wyandotte	lb.	.1325	.1425
Flexol 3 GH	lb.	.44	.46
3 GO	lb.	.53	.55
4 GO	lb.	.325	.355
10-A	lb.	.425	.455
426	lb.	.27	.30
810, 810X, 10-10, 10-10X	lb.	.305	.335
TOF, A-26	lb.	.435	.465
Flexricin P-1	lb.	.295	.31
P-4	lb.	.285	.30
P-8	lb.	.305	.32
PG-16	lb.	.335	.35
Fortex	lb.	.125	.145
G. B. Asphaltic Flux	gal.	.08	.14
Naphthenic Neutrals	gal.	.11	.18
Process oil, light	lb.	.025	.0325
Medium	lb.	.035	.0425
Galex W-100	lb.	.155	.18
W-100 D	lb.	.1525	.1775
Gilsowax B	lb.	.0975	.11
Harchemex	lb.	.25	.34
Harflex 10	lb.	1.25	1.335
40	lb.	.64	.725
50, 80, 300	lb.	.58	.665
60	lb.	.62	.705
90	lb.	.88	.965
120, 150	lb.	.305	.395
Harflex 140, 160	lb.	$0.30	$0.33
180	lb.	.295	.38
220, 250	lb.	.425	.515
260	lb.	.42	.45
280	lb.	.42	.51
500	lb.	.315	.405
HB-20	lb.	.15	.17
-40	lb.	.19	.21
Heavy Resin Oil	lb.	.0225	.0375
HSC-13	lb.	.27	.30
Indonex	gal.	.11	.19
Kapsol	lb.	.3225	.3525
Kenflex A, L	lb.	.26	.27
B	lb.	.23	.24
N	lb.	.18	.19
Kessoflex 103	lb.	.405	
105	lb.	.3325	
106	lb.	.38	
107	lb.	.525	
110	lb.	.24	
111	lb.	.28	
KP-23	lb.	.29	.32
-90	lb.	.40	.43
-140	lb.	.46	.485
KP-201	lb.	.5825	.5925
-220	lb.	.31	.34
-555	lb.	.45	475
Kronisol	lb.	.33	.355
Kronitex AA, I, K-3, Mx	lb.	.345	.375
Marvinol plasticizers	lb.	.28	.8825
Methox	lb.	.385	.41
Monoplex S-38	lb.	.215	.24
S-71	lb.	.45	.475
Morflex	lb.	.25	.65
Natac	lb.	.12	.13
Neoprene Peptizer P.-12	lb.	1.05	
Nevillac	lb.	.39	.85
Neville R Resins	lb.	.15	.35
Nevinol	lb.	.20	
No. 1-D heavy oil	lb.	.065	
ODA (octyldecyladipate)			
Cabflex	lb.	.425	.455
Good-rite GP-235	lb.	.425	.57
ODP (octyldecylphthalate)			
Cabflex	lb.	.305	.335
Good-rite GP-265	lb.	.305	.455
Hatco	lb.	.305	.335
Rubber Corp. of America	lb.	.305	.45
Ohopex R-9	lb.	.3525	.3775
Q-10	lb.	.295	.325
Orthonitro benzophenol, comml.	lb.	.13	.15
Monsanto	lb.	.13	.15
Palmalene	lb.	.15	
Panaflex BN-1	lb.	.185	.225
Para Flux, regular	gal.	.10	.2125
No. 2016	gal.	.165	.24
2332	gal.	.11	
4205	lb.	.1075	.2125
Para Lube	lb.	.046	.048
Resins	lb.	.04	.045
Paralene Resins	lb.	.065	.075
Paraplex 5-B	lb.	.29	.3475
AL-111	lb.	.32	.3275
G-25	lb.	.76	.77
-40	lb.	.51	.52
-50	lb.	.4025	.4275
-53	lb.	.45	.475
-60	lb.	.325	.35
-62	lb.	.345	.37
RG-7	lb.	.33	.335
-8	lb.	.505	.5125
-10	lb.	.52	.5275
Pepton 22	lb.	.79	.82
Philrich 5	gal.	.11	
Picco Resins	lb.	.135	.195
480 Oilproof Series	lb.	.18	.23
Aromatic Plasticizers	lb.	.05	.065
Liquid Resin D-165 (Y)	lb.	.06	.075
(Z-3)	lb.	.07	.085
(Z-6)	lb.	.08	.095
S. O. S.	gal.	.29	.34
Piccocizers	lb.	.04	.055
Piccolastic Resins	lb.	.1855	.34
Piccolyte Resins	lb.	.185	.25
Piccopale Resins	lb.	.12	.135
Piccovars	lb.	.165	.20
Piccovol	lb.	.025	.038
Pictar	gal.	.25	.30
Pigmentar	lb.	.046	.0745
Pigmentaroil	lb.	.046	.0745
Pine Tar, Sunny South	lb.	.046	.0801
Oil, Sunny South	lb	.046	.0801
Pitch, Burgundy, Sunny South	lb.	.1030	.1085
Plasticizers			
42	lb.	.34	.40
B	lb.	.35	.45
DP-520	lb.	.435	.455
MP	lb.	.035	.0755
MT-511	lb.	.535	.565
ODN	lb.	.32	.37
SC	lb.	.54	.63
Plastoflex #3	lb.	.52	.57
#520	lb.	.36	.435
DBE	lb.	.50	.55
MGB	lb.	.29	.37
SP-2	lb.	.43	.48
VS	lb.	.3575	.3975
Plastogen	lb.	.0775	.08
Plastone	lb.	22	.3075
Polycin 470	lb.	.275	.29
Polycizers	lb.	.40	.47
Polymel D	lb.	.225	.235
C-128	lb.	.1775	.1875
D-TAC	lb.	.1975	.215
DX, C-130	lb.	.1375	.1475
PT67 Light Pine Oil	gal.	$0.60	
101 Pine Tar Oil	lb.	.046	$0.0634
Pine Tars	lb.	.046	.0634
R-19, R-21 Resins	lb.	.1075	
Reogen	lb.	.1325	.135
Resin C pitch	lb.	.0225	.031
R6-3	lb.	.38	.40
Resinex 10, 25, 50, 110	lb.	.04	.045
70	lb.	.0325	.0375
85, 100	lb.	.035	.04
115	lb.	.0375	.0423
L-2, L-3, L-4, L-5	lb.	.0225	.03
Rosin Oil, Sunny South	gal.	.58	.875
RPA No. 2	lb.	.78	
3	lb.	.47	
Conc.	lb.	.97	
5	lb.	.59	
RSN Flux	gal.	.10	.19
Rubber Oil B-5	lb.	.0225	.0355
Rubberol	lb.	.2575	.2725
Santicizer 1-H	lb.	.50	.51
3	lb.	.46	.47
8	lb.	.43	.44
9	lb.	.39	.42
140	lb.	.33	.36
Santicizer-141	lb.	.34	.37
160	lb.	.25	.28
601	lb.	.325	
602	lb.	.305	
B-16	lb.	.4875	.4975
E-15	lb.	.5075	.5375
M-17	lb.	.4275	.4575
Sebacic acid, purified, comml.	lb.	.59	.65
Binney & Smith	lb.	.64	.76
Hardesty	lb.	.64	.76
C.P.-Binney & Smith	lb.	.72	.84
Hardesty	lb.	.72	.84
Sherolatum Petrolatum	lb.	.05	.10
Softener #20	gal.	.10	.20
Special Rubber Resin 100	lb.	.1675	.2175
Staflex AX	lb.	.43	
DBES	lb.	.61	.635
Syn-Tac	gal.	.33	.35
Synthol	lb.	.2475	
Thiokol TP-90B	lb.	.59	
-95	lb.	.65	
Tricresyl phosphate, comml.	lb.	.33	.36
Cabflex	lb.	.345	.375
Monsanto	lb.	.33	.36
Naugatuck	lb.	.33	.36
PX-917	lb.	.33	.36
Triphenyl phosphate, comml.	lb.	.39	.40
Monsanto	lb.	.39	.40
Turgum S	lb.	.1075	.1175
Tysonite	lb.	.24	.2475
United	gal.	.69	1.20
X-1 Resinous Oil	lb.	.021	.0275

Reclaiming Oils

Acintol C, P	lb.	.02	.03
Bardol, 639	lb.	.0275	.0375
B	lb.	.0625	.065
RRH 2	lb.	.0213	.0351
BRT 3	lb.	.018	.0265
4	lb.	.025	.026
7	lb.	.03	.031
BRV	lb.	.0475	.0565
Burco-RA	lb.	.053	.0805
BWH-1	lb.	.16	.18
Dipolymer Oil	gal.	.33	.43
Dispersing Oil No. 10	lb.	.06	.0625
G. B. Oils	gal.	.10	.24
Heavy Resin Oil	lb.	.0225	.0375
LX-777	gal.	.23	.33
No. 3186	gal.	.28	.295
Picco 6535	gal.	.25	.30
C-33	gal.	.215	.315
-42	gal.	.23	.33
D-4	gal.	.27	.37
E-5	gal.	.25	.35
Q-Oil	gal.	.286	.36
PT 67	gal.	.60	
101 Pine Tar Oil	lb.	.0427	.0610
150 Pine Solvent	gal.	.44	
Reclaiming Oil #3186	gal.	.28	.385
-G	gal.	.25	.365
4039-M	gal.	.3275	.3975
-V	gal.	.30	.37
RR-10	lb.	.36	
S. R. O.	lb.	.015	.0225
X-1 Resinous Oil	lb.	.021	.03

Reinforcers, Other Than Carbon Black

American Resinous Chemical			
978-42B	lb.	.18	.19
1073-18B	lb.	.135	.145
1294-36B	lb.	.115	.125
1301-12B	lb.	.15	.16
Angelo Shellacs	lb.	.485	.7325
BRC 20	lb.	.15	.175
22	lb.	.025	.0275
30	lb.	.0125	.021
521	lb.	.019	.02
Bunarex Resins	lb.	.065	.1225
Cab-o-sil	lb.	.68	.75
Calcene NC	ton	72.50	92.50
TM	ton	75.00	95.00
Calco S. A	lb.	.85	.88
Clays			
Aiken	ton	14.00	
Buca	ton	45.00	
Burgess HC-75	ton	12.00	30.00
HC-80	ton	14.00	32.00
Iceberg	ton	50.00	60.00
Pigment No. 20	ton	35.00	60.00
30	ton	37.00	60.00

SITUATIONS OPEN (Continued)

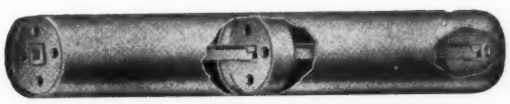
TOP-FLIGHT SALES AGENT

with substantial following among leading rubber companies in the Akron area to represent one of the nation's largest synthetic textile manufacturing concerns. We are interested in establishing a volume business. No objection to non-conflicting lines. Straight commission. Location Akron area. Address Box No. 1923, care of RUBBER WORLD.

MACHINERY AND SUPPLIES FOR SALE

KUX 2½"-DIA. SINGLE-PUNCH PREFORM MACHINE. FARREL 15" x 36" 2-roll Rubber Mill and sizes up to 84". New and used Lab. 6" x 13", 6" x 16", and 8" x 16" Mills and Calenders. Day Imperial 75- & 150-gal. Jack. Mixers. Baker-Perkins Jacketed Mixers 100, 50, and 9 gals. Farrel 200-ton Hydr. Press, 20" x 80" platens. Brunswick 225-ton, 21" x 21" platens, 150-ton 24" x 24" platens. 80-ton 20" x 20" platens. Large stock Hydraulic Presses, 12" x 12" to 48" x 48" platens. Hydraulic Pumps and Accumulators. Hartig 3¼" Extruder, also 1½" to 4½" sizes. Rotary Cutters. Stokes Molding Presses. Single-Punch & Rotary Preform Machines. Banbury Mixers, Crushers, Churns, Bale Cutters, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn 15, N. Y. STerling 8-1944.

STEEL CALENDER STOCK SHELLS



ALL STEEL, ALL WELDED CONSTRUCTION, with forged steel hubs for 1¼", 1½" and 2" square bars. 4", 5", 6", 8", 10", 12", 15", 20" and 24" diameters. Any length. Also Special Trucks (Leaf Type) Racks, Tables and Jigs.

Used in manufacturing rubber and plastic products.

THE W. F. GAMMETER COMPANY
CADIZ, OHIO

BLACK ROCK WASHER CUTTER

FOR CUTTING WASHERS UP TO 3" O.D.

Write, wire, phone today for further information

FINE BR TOOLS

BLACK ROCK MFG. CO.
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NEW YORK OFFICE: 261 BROADWAY

NEW and REBUILT MACHINERY

Since 1891

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Trenton, N. J., Akron, Ohio, Chicago, Ill., Los Angeles, Calif.

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Central Street — QUALITY MOULDS FOR ALL PURPOSES — South Easton, Mass.

THE FIRST STEP — A QUALITY MOULD

GUARANTEED REBUILT MACHINERY

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MILLS, CALENDERS, TUBERS
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HYD. PRESSES, PUMPS, MIXERS
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UNITED RUBBER MACHINERY EXCHANGE
183-189 ORATON ST. CABLE "URME" NEWARK 4, N. J.

ROTEX SCRAP

BUYING AND SELLING

RUBBER	PLASTICS	SERVICES
Uncured Stocks	Vinyl — Polyethylene	Mill—Compounding
Scorched Compounds	Bought—Graded—Sold	Extruding—Straining
Cured Overflow	Cuttings, trimmings, Overflow.	Grinding—Pelletizing
Graded to specification	Slabs, Lumps, Discontinued Lots	Coloring
		Virgin Dry—Blending

ROTEX RUBBER COMPANY, INC., 1-23 JABEZ ST., NEWARK 5, N. J. • TEL. MARKET 4-4444

Clays (*cont'd*)				
Catalpo	ton	$35.00		
Crown	ton	14.00		$33.00
Dixie	ton	14.00		
Franklin	ton	13.50	/	35.25
L. G. B.	ton	17.00		
Paragon	ton	13.50	/	33.00
Pigment No. 33	ton	37.00		
Recco	ton	14.00		
Suprex	ton	14.00	/	33.50
Swanee	ton	12.50		
Whitetex	ton	50.00		
Windsor	ton	14.00	/	30.00
Witco No. 1	ton	14.00	/	30.00
No. 2	ton	13.50	/	30.00
Clearcarb	lb.	.1175/		.1255
Cumar Resins	lb.	.065	/	.17
Darex Resins	lb.	.42	/	.49
Diatomaceous silica	ton	32.00	/	48.00
Good-rite Resin 50	lb.	.39	/	.41
K Series Polymers	lb.	.15	/	.37
Hi-Sil 101	lb.	.10	/	.115
233	lb.	.09	/	.105
X303	lb.	.40	/	.45
Hycar 2001	lb.	.55		
2007	lb.	.39		
Indulins	lb.	.06	/	.08
Kralac A-EP	lb.	.43	/	.54
Laminar	ton	30.00		
Magnesium carbonate, Merck	lb.	.105	/	.12
Marbon Resins	lb.	.39	/	.46
Multifex MM	ton	110.00	/	125.00
Super	ton	160.00	/	175.00
Neville Resins				
465	lb.	.07/		.0825
G	lb.	.13		
LX-509	lb.	.35		
Nebony	lb.	.04	/	.0575
Paradene	lb.	.065	/	.075
R	lb.	.13	/	.18
Para Resins 2457, 2718	lb.	.04	/	.4575
Parapol S-Polymers	lb.	.44		
Picco Resins	lb.	.13	/	.185
Piccolyte Resins	lb.	.205	/	.275
Piccoumaron Resins	lb.	.07	/	.19
Piccovars	lb.	.145	/	.20
Pliolite NR types	lb.	.98	/	1.33
S-3, -6	lb.	.42	/	.49
-6B	lb.	.39	/	.46
Pureral M	ton	56.75	/	71.75
SC, T	ton	110.00	/	125.00
U	ton	120.00	/	135.00
R-B-H 510	lb.	.15	/	.22
Resinex	lb.	.0325/		.0425
Rubber Resin LM-4	lb.	.28	/	.35
Silene EF	ton	120.00	/	140.00
Silvacons	ton	55.00	/	85.00
Witcarb R	ton	105.00	/	120.00
-12	ton	45.00	/	66.00
Zeolex 23	ton	120.00	/	140.00
Zinc oxide, commercial†	lb.	.135	/	.1775

Retarders

Benzoic acid TBAO-2	lb.	.44	/	
E-S-E-N	lb.	.35	/	.37
Good-rite Vultrol	lb.	.62	/	.66
R-17 Resin	lb.	.1075/		.36
Retarder ASA	lb.	.57		
J	lb.	.62	/	.64
PD	lb.	.35	/	.37
W	lb.	.45		
Retardex	lb.	.47	/	.50
Thionex	lb.	1.14		

Solvents

Bondogen	lb.	.55	/	.60
Butyrolactone	lb.	.60	/	.65
Cosol #1	gal.	.37	/	.43
#2	gal.	.42	/	.48
Dichloro Pentanes	lb.	.04	/	.07
Dipentene DD, Sunny South	gal.	.40	/	.62
Ethylene dichloride, commil.	lb.	.09	/	.1225
Hi-Flash 2-50-W	gal.	.41		
Pale yellow	gal.	.39		
LX-572	gal.	.27	/	.32
-748	gal.	.16	/	.23
n-Methyl-2-pyrrolidone	lb.	.75	/	.80
Neville Nos. 100, 104	gal.	.52	/	.60
106	gal.	.38	/	.46
Nevsol B	gal.	.20	/	.30
H, 200	gal.	.19	/	.29
HF, T, 30	gal.	.24	/	.34
Penetrell	gal.	.40	/	.62
Picco Hi-Solv Solvents	gal.	.16	/	.48
Pine Oil DD, Sunny South	lb.	.1225/		.1425
PT 150 Pine Solvent	gal.	.44		
Skellysolve-E	gal.	.153		
-H	gal.	.133		
-R, -V	gal.	.109		
-S	gal.	.099		
Stauffer Carbon Disulphide	lb.	.0525/		.085
Tetrachloride	lb.	.0825/		.475

Synthetic Rubber Monomers

Dow Styrene N99, H99	lb.	.205		
RG	lb.	.17		
Vinyltoluene	lb.	.17		
Hylene T	lb.	1.15		
TM, TM-65	lb.	1.05		
Monomer MG-1	lb.	1.00	/	1.25
Rohm & Haas ethyl acrylate	lb.	.34		
Methyl acrylate	lb.	.37		
Methacrylate	lb.	.29	/	.31

Synthetic Rubber Shortstops

DDM	lb.	$0.75	/	$0.88
Mercaptan 174	lb.	.38	/	.50
Shortstop 204	lb.	.33	/	.37
268	lb.	.52	/	.53
Thiostop K	lb.	.53		
N	lb.	.41		

Tackifiers

American Resinous Chemical				
A25, A26, 716-30	lb.	.18	/	.19
555-40R	lb.	.185	/	.205
620-32B	lb.	.20	/	.21
716-35	lb.	.17	/	.18
1041-21	lb.	.165	/	.175
Acintol R	lb.	.065	/	.07
Bardol, 639	lb.	.0275/		.0375
BRH 2	lb.	.0213/		.0351
Bunarex Resins	lb.	.065	/	.1225
Chlorowax 70	lb.	.18	/	.24
Contogums	lb.	.0875/		.11
Cumar Resins	lb.	.065	/	.17
Galex W-100	lb.	.155	/	.17
W-100D	lb.	.1525/		.1625
Indopol H-35	gal.	.65	/	.81
H-50	gal.	.70	/	.86
-100	gal.	.85	/	1.05
-300	gal.	1.00	/	1.21
L-10	gal.	.40	/	.56
-50	gal.	.45	/	.61
-100	gal.	.55	/	.71
Kenflex resins	lb.	.18	/	.27
Koresin	lb.	.90	/	1.10
Natac	lb.	.12	/	.13
Nevindene	lb.	$0.15	/	$0.18
Picco Resins	lb.	.13	/	.185
Piccolastic Resins	lb.	.1855/		.34
Piccolyte Resins	lb.	.185	/	.25
Piccopale Resins	lb.	.089	/	.13
Piccoumaron Resins	lb.	.07	/	.185
R-B-H 510	lb.	.15	/	.22
Roelflex 1118A	lb.	.39		
Synthetic 100	lb.	.41		
Synthol	lb.	.2475/		.2625
United	gal.	.69	/	1.20

Vulcanizing Agents

Dibenzo G-M-F	lb.	2.60		
G-M-F #113, #117	lb.	90		
Ko-Blend I, S	lb.	.39		
Litharge (*See Accelerator-Activators, Inorganic*)				
Magnesium oxide	lb.	.2525/		.38
Merck, Light Calcined	lb.	.2525/		.26
Extra Light Calcined	lb.	.2925/		.30
Red Lead (*See Accelerator-Activators, Inorganic*)				
Sufsal R	lb.	1.50		
Sulfur flour, commil	100 lbs.	2.30	/	3.05
Aero	100 lbs.	2.15	/	7.50
Crystex	lb.	.195	/	.23
Insoluble 60	lb.	.125	/	.13
Rubbermakers	100 lbs.	2.40	/	4.30
Stauffer	lb.	.024	/	.0515
Telloy	lb.	2.50		
VA-7	lb.	.50	/	.60
Vandex	lb.	15.50		
Vultac No. 2	lb.	.47	/	.755
3	lb.	.51	/	.795
White lead silicate (*See Accelerator-Activators, Inorganic*)				

CALENDAR of COMING EVENTS

May 16-18

Division of Rubber Chemistry, ACS. Hotel Cleveland, Cleveland, O.

May 25

Connecticut Rubber Group. Reclaimed Rubber Symposium.

May 28-30

Chemical Institute of Canada. Thirty-Ninth Annual Conference & Exhibition. Mt. Royal Hotel, Montreal, P.Q., Canada.

(Rubber Division, May 30.)

June 3-8

Society of Automotive Engineers. Annual Meeting. Chalfonte-Haddon Hall, Atlantic City, N. J.

June 7

New York Rubber Group. Outing. Doerr's Grove, Millburn, N. J.

Rhode Island Rubber Club. Outing. Pawtucket Country Club, Pawtucket, R. I.

June 8

Fort Wayne Rubber & Plastics Group. Summer Golf Outing. Tippacanoe Lake Country Club, Leesburg, Ind.

June 9-10

The Los Angeles Rubber Group, Inc. Summer Outing. Hotel del Coronado, San Diego, Calif.

June 11-15

Seventh National Plastics Exposition and Conference. Coliseum and Hotel Commodore, New York, N. Y.

June 13

Buffalo Rubber Group. Outing.

June 15

Akron Rubber Group. Outing. Firestone Country Club, Akron, O.

Boston Rubber Group. Outing. Andover Country Club, Andover, Mass.

June 17-21

American Society of Mechanical Engineers. Semi-Annual Meeting. Hotel Statler, Cleveland, O. (Rubber Plastics Division, June 18.)

June 17-22

American Society for Testing Materials. Annual Meeting and Twelfth Exhibit of Testing & Scientific Apparatus & Laboratory Supplies. Chalfonte-Haddon Hall, Atlantic City, N. J. (Committee D-11 on Rubber, June 20-22.)

June 20-21

Division of High-Polymer Physics, APS, and Division of Colloid Chemistry, ACS. Joint Symposium on "Diffusion" and "Flow Processes in Polymers." Madison, Wis.

June 22

Detroit Rubber & Plastics Group. Outing. Western Country Club.

July 21

Chicago Rubber Group. Outing.

July 30-August 3

Gordon Research Conference of the American Assn. for the Advancement of Science. 1956 Conference on Elastomers. Colby Junior College, New London, N. H.

August 2

New York Rubber Group. Golf Tournament. Innis Arden Golf Club, Old Greenwich, Conn.

August 17

Philadelphia Rubber Group. Outing. Manufacturers Golf & Country Club, Oreland, Pa.

September 8

Connecticut Rubber Group. Outing.

September 10-12

American Society of Mechanical Engineers. Fall Meeting. Denver, Colo.

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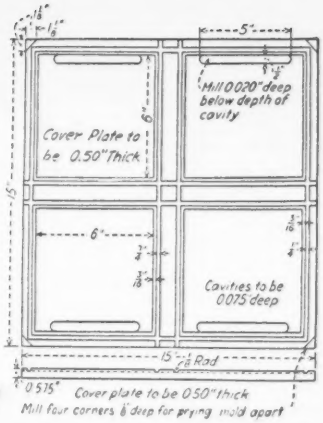
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Mill 0.020" deep below depth of cavity
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6"
Cavities to be 0.075 deep
15"
0.515"
Cover plate to be 0.50" thick
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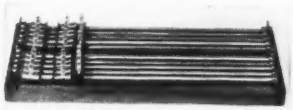

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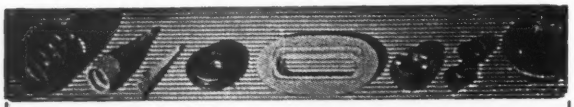

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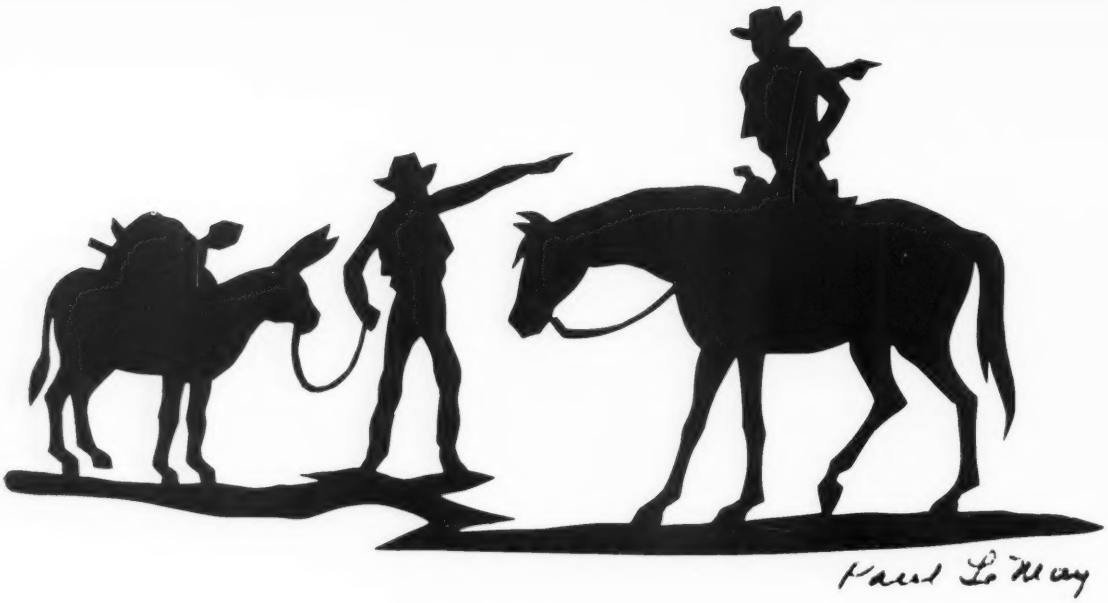

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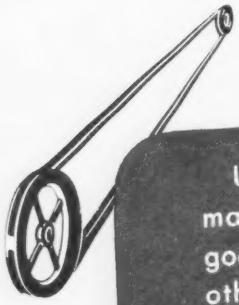

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